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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 3217
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 3219
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3220
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3220
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3221
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3221
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3222
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3222
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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CONTRACT NUMBER INDEX I-95
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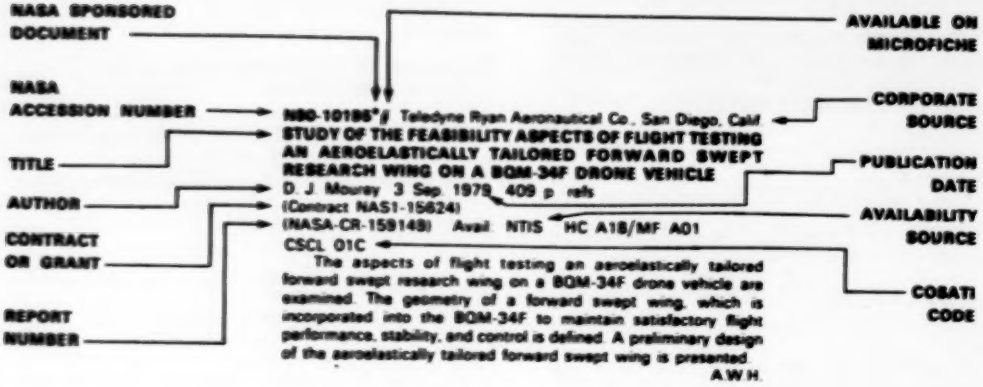
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MINIMIZATION OF DIFFERENCES BETWEEN SIMULATED AND ACTUAL FLIGHT DATA FOR AREA NAVIGATION ON HIGH SPEED AIRCRAFT
A. Hargrove, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NAG 1-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0002, NON-STEADY COMBUSTION IN BURNERS FOR AIRCRAFT GAS TURBINES
F.E. Marble, California Inst. of Technology, School of Engineering, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 3-70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0003, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS ANALYSIS OF COMPRESSIBLE FLOW IN SUBSONIC DIFFUSERS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, THE JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS EXPERIMENTAL INVESTIGATION OF FLOW OVER A SINGLE BACKWARD FACING STEP
S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, DROPLET IMPACT DYNAMICS AND HEAT TRANSFER
W.W. Bowley, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Mechanical Engineering, *Box U-37, Storrs, Connecticut* 06268 (NAG 3-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0006, TRANSONIC AIRFOIL DESIGN BY OPTIMIZATION METHODS IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT NASA-LANGLEY RESEARCH CENTER
M.M. Hafez, George Washington University, Graduate School, *901 23rd St. N.W., Washington, District of Columbia* 20037 (NAG 2-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0007, SYSTEM 2000 AIRCRAFT/STORE INTERFACE DATA SYSTEM
J. Terranova, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF645320)

Air Force function - compatibility analyses and configuration control of aircraft and weapon interfaces. Deficiency - the aircraft/store interface data system (ASIDS), which was developed as a tool to assist in the above function, requires conversion to the System 2000 procedural language interface to simplify user access and system output. Objective - produce System 2000 PLI analysis software for the ASIDS to make the ASIDS capabilities available as a System 2000 resource. How work contributes - this effort will provide the DOD aircraft and store communities with a multi-user, accessible and centrally controlled aircraft/store electrical interface analysis capability.

The ADTC Math Laboratory will be tasked to convert the existing ASIDS electrical interface analysis software into System 2000's PLI software. Complete documentation in accordance with established military standards will be a product of this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0008, PREDICTION OF SOUND RADIATION FROM DIFFERENT PRACTICAL JET ENGINE INLETS
B.T. Zinn, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NAG 3-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, THE MECHANISMS OF FLAME HOLDING IN THE WAKE OF A BLUFF BODY
R.A. Strehlow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (NAG 3-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, WATER DROPLET DYNAMICS IN ANNULAR CASCADE
S.N. Murthy, Purdue University, School of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 3-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0011, AN ASSESSMENT OF GENERAL AVIATION DEICING SYSTEMS ON CONTEMPORARY AIRFOILS
D.L. Kohlman, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 3-71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0012, DEVELOPMENT OF UNSTEADY SUCTION ANALOGY
C.E. Lan, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 1-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, RESEARCH ON UNSTEADY, THREE-DIMENSIONAL TRANSONIC FLOW
W.L. Harris, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0014, A STUDY OF SUPERSONIC THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS
A. Demetriades, Montana State University, School of Engineering, Dept. of Mechanical Engineering, *Bozeman, Montana* 59715 (NAG 2-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, MODEL DEVELOPMENT FOR SHOCK WAVE BOUNDARY LAYER INTERACTION EXPERIMENT
I. Greber, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0016, LAMARS MOTION MODIFICATION STUDY
L.R. Maki, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144190)

This effort supports engineering simulation research and development conducted in the Flight Control Development Laboratory. The AFFDL large amplitude multimode aerospace research simulator (LAMARS) has recently been found to have motion deficiencies which appear to be primarily software-oriented. The objective is to substantially reduce, if not eliminate, these deficiencies by analyzing and modifying the present motion system software. The quality of the motion cues has a direct bearing on the effectiveness of LAMARS simulations.

A thorough review and analysis of the LAMARS motion system software will be conducted. Available data on washout effects and adjustments will be compiled and assessed. Washout analysis will be performed on the CDC computer system. An analysis of the LAMARS system hardware will also be conducted as a performance check. Following demonstration and evaluation of the modified system, a manned simulation evaluation will be performed. Availability of the LAMARS system will affect the completion dates of certain portions of the project requiring its use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, VISUAL SYSTEM MICROPROCESSOR DRIVE IMPLEMENTATION
J. Pollard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143790)

This effort is in support of the engineering R&D simulation mission of the engineering flight simulation facility (AFFDL/FGD). It addresses the method of controlling and driving the terrain model visual system resident at the facility. The objective is to design and implement a microprocessor-based system for controlling and driving this system, with both hardware and software development anticipated. Fruition will result in the 'freeing' of a valuable general purpose computer for other applications, and help to establish in-house expertise in this area.

The approach involves a cooperative effort between AFFDL/FGD and USAFA/DFEE over approximately a one-year period. Most hardware and system software aspects will be handled by DFEE, while visual-related software will be handled primarily by FGD. Cross-involvement is of course expected and is to be encouraged for training reasons. A project schedule is currently under mutual formulation and review. The scheduling indicates parallel development of hardware and software portions with mutual feedback influencing later portions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, FLAP-LAG-TORSIONAL DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT
M.R. Crespo Da Silva, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 2-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0019, DEVELOPMENT OF AN AIRFOIL ICE ACCRETION MODEL
J.K. Luers, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAG 3-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0020, THE SPINNING OF LIGHT AIRCRAFT
B.W. McCormick, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NAG 1-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0021, GENERATION OF COST- AND FUEL-OPTIMAL VERTICAL FLIGHT PROFILES
J.F. Wiggs, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NAG 1-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, EFFECTS OF PAYLOAD HANDLING CONSIDERATIONS ON SPACE SHUTTLE TRAJECTORIES DURING PROXIMITY OPERATIONS
W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Research is being conducted into the proximity operations, or rendez-vous, phase of space shuttle missions involving payload recovery. One- and two-impulse trajectories from station-keeping locations within 1000 feet of the target body payload are being considered. A one-impulse trajectory is defined to have a final relative velocity less than or equal to 0.2 ft./sec. This value is the maximum allowable rate (at maximum payload mass of 3200 lbs.) for RMS capture. All successful rendez-vous

trajectories must meet rigid constraints on plume impingement, crew visibility, total fuel consumption, total coast time (time from first impulse to final approach), and safety. This continuing project is in its second year.

SUPPORTED BY University of Texas

2.0002, NONLINEAR ESTIMATION THEORY
B.D. Tapley, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: By the application of the Martingale Theory and smoothing properties to the study of nonlinear stochastic dynamic systems, an approximate nonlinear estimation algorithm has been developed. In order to determine its effectiveness, the nonlinear estimation algorithm as well as the extended Kalman filter are applied to the problem of estimating the trajectory of a planetary spacecraft using range, range-rate, sun-planet and star-planet angle measurements. The result of the computer-simulated study shows that the nonlinear algorithm is superior to the extended Kalman filter when the measurements are highly nonlinear. A comparison of the algorithm with other nonlinear estimation algorithms is being made also. This line of research is expected to extend for several years.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF MITOCHONDRIA AS A MEANS TO DETERMINE THE EFFECTS OF SPACE WEIGHTLESSNESS ON THE AGING PROCESS OF DROSOPHILA
L.S. Yengoyan, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCA 2-675004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, SELECTION AND TESTING OF DIAPHRAGM MATERIALS FOR HIGH TEMPERATURE PRESSURE TRANSDUCERS
J.D. MacKenzie, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 3-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0003, LIQUID LITHIUM CORROSION AND CORROSION FATIGUE RESEARCH
Unknown, Colorado School of Mines, Graduate School, *Golden, Colorado* 80401 (EY-76-S-02-2313)

Liquid lithium corrosion kinetics (weight loss and intergranular penetration) of ferrous alloys are being established as a function of impurity content, temperature and stress. Materials being investigated are iron, iron-chromium and iron-chromium-nickel alloys, such as 2 1/4 Cr - 1 Mo steel and type 304 stainless steel. Deformation-enhanced corrosion is being studied by various modes of loading, including torsional fatigue techniques which allow large amounts of strain without specimen instability. Spindle techniques are also being applied to determine the influence of the fluid velocity of the liquid lithium. Mossbauer spectroscopy, Auger secondary electron spectroscopy and electron microscopy are being applied to better understand the nature of the lithium-penetrated grain boundaries.

RESULTS: Mathematical expressions for grain boundary penetration and weight loss rate coefficients, as functions of the nitrogen content and temperature, were established for 304L stainless steel in liquid lithium. The environmental conditions where each mode of attack is dominant are being determined. Deformation-enhanced corrosion behavior has been reported. An MTS mechanical testing system has been installed in a protective atmosphere box to determine the role of deformation of the corrosion processes.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0004, RESEARCH ON DEFORMATION PROCESSES IN REFRACTORY METALS
Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (EY-76-S-05-3262)

The mechanical properties of metals and alloys can be strongly influenced by phenomena other than simple slip. Among these perturbing phenomena are dynamic strain-aging, mechanical twinning, and dynamic recovery. The nature of these, and the magnitude of their effects on the stress-strain behavior of the metals titanium, niobium, vanadium and tantalum containing interstitial impurities, are being determined. Emphasis is now being placed on an attempt to find interrelations between dynamic strain-aging and slow strain-rate embrittlement. In transition metals, both types of phenomena can be caused by interstitial elements such as hydrogen, oxygen, nitrogen and carbon when the latter is in solid solution. Specific attention is being paid to the niobium-oxygen-hydrogen, niobium-oxygen and vanadium-hydrogen systems. Tensile tests will be carried out to fracture on specimens of high purity niobium and vanadium alloyed with the appropriate interstitials between 4 and 1100 K at several strain rates. Internal friction, fractographic ductility and stress-strain data from these tests will be correlated and analyzed. These tests will be complimented by static strain-aging tests in which the specimens are aged under stress.

RESULTS: During the past year, as part of this project, the diffusion coefficients of oxygen and nitrogen were remeasured in the three type Va metals. Improved torsion pendulum and elastic after-effect techniques were employed. In these procedures the data were analyzed with the aid of a non-linear least squares computer optimization program. These new data, when combined with existing high temperature data in the literature, favor the assumption that O and N occupy octahedral sites in the type Va bcc lattice.

SUPPORTED BY U.S. Dept. of Energy

3.0005, STUDIES OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS INCLUDING ELECTRON IRRADIATION STRENGTHENING OF ALL SINGLE CRYSTALS
M. Meshii, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (EY-76-S-02-1367)

The effect of point defects on the mechanical behavior of b.c.c. metallic single crystals is being investigated. The point defects under investigation are interstitial atoms produced by electron irradiation (1 to approximately 2 MeV) and interstitial solutes introduced by diffusion annealing. This study will characterize the electron irradiation effects on the mechanical properties of metals and alloys and, at the same time, will enhance the understanding of strength and its dependence on experimental parameters such as temperature, strain rate, and structure of specimen materials in terms of the atomic mechanisms involved. The current emphasis is on the comparison of iron and niobium single crystals in the irradiation effect and the surface film effect.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0006, USE OF VERY HIGH PRESSURE TO INVESTIGATE THE STRUCTURE OF MATTER
H.G. Drickamer, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Chemical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The basic thesis of our research is that high pressure is an essential tool for understanding electronic phenomena in condensed systems. With increasing compression there is increased overlap among electronic orbitals. Different types of orbitals are

perturbed to different degrees. A study of these perturbations permits one to characterize electronic states and excitations, to test theories, and, under some circumstances, to induce electronic transitions to new ground states.

Our current research centers around luminescence measurements. We can measure energies and peak shapes over a range from 240 to 1200 nm, lifetimes to as fast as one nanosecond, and efficiencies as low as 10 to the minus 5th power to 10 to the minus 6th power. With these techniques we study the behavior of a variety of organic and inorganic solutes in crystalline, liquid and amorphous (polymers and glasses) media.

The types of phenomena with which we are concerned include energy transfer, Jahn-Teller splitting of excited states, phonon-assisted transitions, radiationless transition rates, intersystem crossing, the mixing of n-pi and pi-pi excitations, and the structure of the excited state in complexes.

SUPPORTED BY U.S. Dept. of Energy

3.0007, SEMICONDUCTOR CRYSTAL GROWTH BY ION BEAM SPUTTERING

J.E. Greene, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-1198)

Energetic particle-surface interactions play a determining role in the growth of compound semiconductor thin films by sputtering. An ultra-high vacuum ion beam sputtering system containing in situ analytic techniques such as low-energy electron diffraction, Auger electron spectroscopy, modulated mass spectrometry, and secondary ion mass spectrometry has been developed in order to investigate the effects of energetic particle bombardments during film growth on elemental sticking probabilities, nucleation kinetics, enhanced interfacial diffusion, and film growth morphology. The growth of metastable alloys is also being studied.

SUPPORTED BY U.S. Dept. of Energy

3.0008, MICROCHEMISTRY OF SOLIDS

C.A. Wert, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Metallurgy & Mining Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

Many second-phase compounds in solids are extremely fine particles and are widely dispersed through the solids. Alloying elements which strengthen materials--commonly carbides, oxides, or nitrides--oftentimes are dispersed in particles of size 50 to a few hundred Angstroms. Determination of crystal structure and chemical compound of these dispersions is being made using quantitative analytical electron microscopy. Using these techniques, we have determined the crystal structure and stoichiometry of carbides in a mixed vanadium-titanium-carbon alloy. Three carbides exist in three aging regions, one just above room temperature, one at about 600 degrees C and one at temperatures over 1000 degrees C. These carbides can be completely characterized down to particle sizes around 300 to 500 A. This work is being transferred to another project and some new work related to microchemistry of inclusions in coal is being investigated. The structure and composition of iron sulfides in a coal char derived from a liquefaction process are being examined. Using transmission electron microscopy, we are beginning to examine the mineral constituents in coal itself.

SUPPORTED BY U.S. Dept. of Energy

3.0009, HIGH-TEMPERATURE EFFECTS OF INTERNAL GAS PRESSURE IN CERAMICS

A.A. Solomon, Purdue Research Foundation, *West Lafayette, Indiana* 47907 (EY-76-S-02-2713)

Experimental study of the role of entrapped gases and microstructure on the rate-controlling mechanisms of pressure-induced densification and swelling of ceramics is to be made, with emphasis on grain size and stoichiometry effects in single-crystal and polycrystalline CoO. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0010, COBALT IN NICKEL-BASE SUPERALLOYS

J.F. Radavich, Purdue University, School of Materials Engineering, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAG 3-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, PHOTOIONIZATION AND FIELD IONIZATION OF HIGHLY EXCITED ONE- AND TWO-ELECTRON ATOMS

D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EG-77-S-02-4370)

Experimental studies of the structure of highly excited (Rydberg) states of one- and two-electron atoms in high electric fields; photoionization processes in atomic species close to their ionization limits. Such species exhibit relatively long lifetimes (compared to those atoms excited in lower levels of excitation) and offer unique opportunities to probe atomic structure and electron correlation phenomena. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

3.0012, NUCLEAR MAGNETIC RESONANCE STUDIES OF POLYPHOSPHAZENE POLYMERS AND METALLIC ALLOYS

P. Sagalyn, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4726)

(1) To determine the microstructure(s) and thermal properties of polymers having phosphorous-nitrogen backbones, and to correlate them with bulk properties to help produce improved polyphosphazenes. (2) By using the electric field gradient to determine the changes which occur in the immediate vicinity of point defects in metals, to improve the characterization of radiation damage, damage due to ion implantation, and solvent-solute interactions. To characterize beryllium metal and alloys via NMR for quality assurance and for gaining understanding that will lead to improved materials for missiles, aircraft and composites.

(1) NMR spin-lattice relaxation times and line parameters will be measured as functions of temperature to characterize the motions of l-side chains and backbone in poly(bis(trifluoroethoxy)phosphazene). If time permits, other poly(alkoxy-phosphazenes) will be examined. (2) Extensions of our theory of EFGS due to point defects in metals will be applied, as time permits, to dilute alloys of and vacancies in aluminum. Manuscripts on Be and BeNi, currently in first draft form, will be completed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0013, THE RADIATION CHEMISTRY OF LIQUID AND PLASTIC CRYSTALS

Unknown, University of Mississippi, University Campus, Graduate School, *126 Biology Bldg., University, Mississippi* 38677 (EY-76-S-05-3781)

The purpose of this investigation is the understanding of the radiation chemistry of compounds in the nematic liquid crystal state and of compounds in the plastic crystal state. From the understanding of the radiation chemistry in these mesomorphic states, it is the intention of this study to develop a model or models to explain the effects of radiation. Due to the liquid-like nature of these mesomorphic states, the initial effort is directed to a modified diffusional model.

In addition to the standard radiation chemical approach to this problem, several other approaches are being made. One of these involves determination of the rotational energy barriers from polarized optical transmission spectra. The second involves determination of the diffusional barriers from nmr T1 (rho) measurments. The third approach involves determination of the initial G-values and nature of the species initiating the reactions from positron probe lifetime studies.

SUPPORTED BY U.S. Dept. of Energy

3.0014, HYDROGEN CYANIDE REACTIONS IN COMBUSTION SYSTEMS
W.J. McLean, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (EG-77-S-02-4457)

Studies of the chemical processes associated with hydrogen cyanide in combustion environments by the use of a single pulse shock tube with product analysis by gas chromatography. A high temperature fast flow reactor is also used with product analysis by quadrupole mass spectrometry. The two techniques make possible observations spanning a wide range of reaction times and temperatures; comparison of measured compositions with predictions based on plausible models for the reactions. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

3.0015, DEFECTS OF METAL CRYSTALS
R.W. Balluffi, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (EY-76-S-02-3158)

The objective of the present research effort is a broad investigation of the properties of crystal defects in metal crystals. Attention during the past year was focused on point-defects (vacancies, self-interstitial atoms (both substitutional and interstitial) and aggregates of point-defects. A strong emphasis was placed on the use of different irradiating species (300-700 eV Xe positive ions, 100 to 1500 eV He positive ions, 250 to 2000 eV Ne positive ions, 30 keV W positive Mo positive or Cr positive ions, and fast neutrons) to introduce both vacancies interstitials (self and impurity) in a number of different pure metals (Mo, Au, W) and alloys (W(Re)), Mo (Ti), Mo (Ti plus Zr), Ni4Mo, Pt3CO, Ni3Fe and Ni3Mn). Progress was made in the following areas: (A) The Direct Observation of the Point-Defect Structure of Depleted Zones in Ion-Irradiated Metals; (B) The Spatial Distribution of Self-Interstitial Atoms Within and Around Depleted Zones; (C) An FIM Study of Stage I Recovery of Ion-Irradiated Molybdenum; (D) The Transmission Sputtering of Gold Thin Films by Low Energy (less than 1 keV) Xenon Ions; (E) Atom-Probe Field-Ion Microscope Studies; (F) The Range of Focused Collision Replacement Sequences in Ordered Alloys and the Random Disordering of Ordered Alloys; (G) The Recovery Behavior in Stages I, II and III of Proton-Irradiated Tungsten; and (H) the Fast-Neutron Irradiation of Wire Specimens in EBR-II.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0016, ATOMIC AND MOLECULAR PROPERTIES AND THEIR RELATIONSHIP TO SEPARATION PROCESSES
W.L. Taylor, Monsanto Research Corp., Mound Laboratory, *P.O. Box 32, Miamisburg, Ohio* 45342

Investigation of fundamental isotope properties for the improvement of isotope separation processes; experimental and theoretical work on gas transport and thermodynamic properties in solid, liquid, and gas phases; thermal diffusion factors by the Trennschaukel and two-bulb methods; isotopic vapor pressures; mutual diffusion coefficients; total and differential atomic scattering cross-sections; fundamental atomic interactions by evaluation of the intermolecular potential. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0017, CHEMICALLY MODIFIED ELECTRODES
W.J. Wallace, Muskingum College, Undergraduate School, Dept. of Chemistry, *New Concord, Ohio* 43762 (NAG 3-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0018, STUDY OF THE IONIZING RADIATION-INDUCED REACTIONS IN ORGANIC COMPOUNDS
Unknown, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (EY-76-S-02-1116)

Determination of enhancement of Ar excimer and Ar (ls) atom yields by admixture of Ne and Ar, measurement of rate constants for growth and decay of Ar excimers and Ar/Ne mixed excimers, measurement of rate constants for quenching of Ar (ls) atoms and transient and metastable Ar excimers by N2 and elucidation of mechanisms for decay of Ne (ls) atoms in pure Ne gas - by fast spectrophotometric monitoring of absorbing species following passage of brief, high current, high kinetic energy electron beam pulses through samples of rare gases and mixtures containing rare gases.

RESULTS: Ar (ls) atoms in pure Ar decay entirely via formation of Ar excimers at 100 to 700 torr, 153K to 300K. Resonance state Ar (ls) atoms as well as metastable state Ar (ls) atoms decay through first excited singlet excimer state - the latter by means of inverse predissociation from the first metastable state of the excimer. Temperature coefficients of Ar (ls) decay constants are small, positive and attributable to effects of temperature on collision frequencies of elementary steps.

SUPPORTED BY U.S. Dept. of Energy

3.0019, STRUCTURE OF GLASSES CONTAINING TRANSITION METAL IONS
W.B. White, Pennsylvania State University, University Park Campus, Materials Research Lab., *Research Center, Room 212, University Park, Pennsylvania* 16802 (EY-76-S-02-2754)

This research concerns the structure and behavior of insulator glasses with respect to the transition metals as additives. The research strategy is to prepare silicate, borate, and other host glasses, and to study the local structure, interaction with glass structure influence on nucleation and crystallization and phase separation of a selected set of transition metal ions. Experimental approaches include structure of glass by Raman spectroscopy, local structure around transition metal ions by optical absorption and luminescence spectroscopy, experiments on the controlled reduction of the transition metals to investigate the effect of oxygen activity in the glass and the way in which the transition ions are bound to the glass structure. Completed investigations include structure of nitrate glasses, structure of lead silicate glasses, identification of molecular chromate and dichromate groups in silicate and borate glasses, optical and luminescence spectroscopy of Cr3 ions in silicate glass, construction of several theoretical models for molecular relaxation and electron-phonon interactions, and the role of iron and titanium in silicate glasses.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0020, CERAMIC MATERIALS FOR HIGH-TEMPERATURE PRESSURE TRANSDUCERS
R.C. Bradt, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Materials Engineering, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAG 3-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0021, ANGULAR MOMENTUM EFFECTS IN NUCLEAR REACTIONS
Unknown, Texas A & M University, College Station Campus, Cyclotron Inst., Dept. of Chemistry, *College Station, Texas* 77843 (EY-76-S-05-3924)

Research supported by ERDA contract E(40-1)-3924 will be continued. Counter telescopes will be used to measure the yields, energy distributions and angular distributions of elements produced in the reactions induced by heavy ions of energies less than or equal to 100 MeV/amu. Mechanisms of interaction will be deduced. Theoretical models of reaction mechanisms, potential energy surfaces and nuclear properties under conditions of high angular momentum will be tested. Projectiles of 12C, 14N, 16O, 20Ne and 40Ar will be employed. In a collaboration involving LASL, LBL, BNL, ORNL and TAMU, attempts will be made to make direct on-line mass measurements of neutron-rich nuclei produced in the reactions of 800 MeV protons with uranium.

RESULTS: Cross-sections, energy distributions and angular distributions for the deep-inelastic and fusion reactions of 197 MeV 12C with Ni, Y, Ag, Tb and Au targets have been meas-

ured. The gamma-ray multiplicities of products of the reactions of 120 MeV 20Ne with 27Al have been measured. Five new neutron-rich isotopes, 27Ne, 31Mg, 32Mg, 34Al and 39P have been discovered.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

3.0022, IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES

R.S. Gordon, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Materials Science & Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (EY-76-S-02-1591)

Steady-state creep studies (constant load and stress relaxation) under four-point bending and tensile conditions will be conducted at temperatures between 1100 and 1600 degrees C on dense polycrystalline MgO and Al2O3 specimens which have been doped with transition metal impurities (e.g., Fe, Cr, Mg, Mn, Ti). Tests will be conducted over a range of stresses (up to 20,000 psi) and oxygen partial pressures (1-10 atm). Test specimens are fabricated by vacuum hot pressing at 1500-1700 degrees C. After fabrication and before creep, testing specimens are annealed at 1450-1900 degrees C. to stabilize the grain size and/or to insure a uniform impurity distribution.

The overall objective of these studies is to understand the role of impurities in governing the relative roles of the diffusional, unaccomodated grain boundary sliding, and dislocation mechanisms to the high temperature creep of polycrystalline MgO and Al2O3. Secondly, the role of lattice defects which are created by solid solution impurities in diffusional creep processes will be evaluated. Impurities and experimental variables such as temperature, oxygen partial pressure, and grain size which contribute to increased high-temperature creep resistance are of major interest.

RESULTS: The creep of hot-pressed, high purity polycrystalline magnesium oxide takes place both by non-viscous (dislocation) and diffusional modes depending on the stress and grain size. Diffusional creep has been identified in high purity, fine-grained MgO by evaluating transient creep data in terms of simultaneous grain growth. Doping with iron in amounts up to about 5 cation percent has several effects on the high-temperature creep behavior. 1. Diffusional contributions to the creep rate are enhanced and are dominant for small grain sizes and stresses. 2. Increasing amounts of trivalent iron in solid solution lead to increased rates of viscous creep due to cation vacancy information but they have little or no effect on non-viscous or dislocation mechanisms of creep, which are dominant at high stresses in coarse-grained material. Iron in solid solution makes the diffusional creep rate sensitive to the oxygen partial pressure. Creep rates in oxidizing atmospheres are faster than those in reducing environments. (Text Abridged)

SUPPORTED BY U.S. Dept. of Energy

3.0023, X-RAY STUDIES OF THE BEHAVIOR OF TITANIUM AND MOLYBDENUM FILMS ON SILICON SUBSTRATES

C.R. Houska, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (DMR77-26824)

This research will be a study of high-temperature reaction kinetics between thin films of titanium or molybdenum and silicon single crystal substrates. Reaction of such films with silicon to form metal silicides is used to form ohmic contacts and barriers on silicon semiconductor devices.

The major experimental tool to be used in these studies will be X-ray diffraction with supporting scanning electron microscopy. X-ray data will be collected at elevated temperatures to determine the identity, thickness, and orientation factors for each phase formed during the reaction. Computer simulations will be used to fit diffusion profiles. The X-ray line shape data will be analyzed to obtain uniform and non-uniform strain in the film and reaction layers, as well as to obtain subgrain size.

This is a renewal of NSF Grant DMR75-17201.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0024, ENVIRONMENTAL DEGRADATION OF ENGINEERING MATERIALS II

M.R. Louthan, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Materials Engineering, *Blacksburg, Virginia* 24061 (NAG 3-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, RADIATION AND SCATTERING OF IONIZED LIGHTNING CHANNELS

T.H. Shumpert, Auburn University, School of Engineering, Dept. of Electrical Engineering, *Auburn, Alabama* 36830 (NAS 8-33880)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, ELECTROSTATIC FUEL CONDITIONING OF INTERNAL COMBUSTION ENGINES

P.I. Gold, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NAG 3-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0003, STUDY TO DETERMINE POSSIBILITY OF SATELLITE USE IN BPA

Unknown, Edutel Communications Inc., *Palo Alto, California* 94304

SUPPORTED BY U.S. Dept. of Energy

4.0004, MIST-FLOW OCEAN THERMAL ENERGY PROCESS

S.L. Ridgway, R & D Associates, *4640 Admiralty Way, P.O. Box 9695, Marina Del Rey, California* 90291 (W-7405-ENG-26-SUB 7613)

The objective of this project is to determine the feasibility of the mist lift ocean thermal energy process. Essential components of the system are to be developed and tested. The fluid dynamics of the two-phase flow that takes place in the lift tube should be understood in sufficient depth and detail to enable reasonable projections of the operating characteristics and boundaries of the possible capital costs of a mist flow ocean thermal energy plant. The influence of mist parameters (droplet size, droplet size distribution) and transport parameters (pressure gradient, duct profile, and velocity schedule) on the lift effectiveness of the two-phase flow is to be determined.

A thermodynamic analysis of the mist flow process is complete. The two-phase flow analyses were based on the assumption of constant lift effectiveness and preliminary choices of possible duct area profiles, injection velocity, and flow velocity schedule. The results of this analysis were used for the technical and cost assessments. Analyses of experimental results will be followed so that a baseline mist lift efficiency can be established. Previous systems analysis showed that a low lift efficiency would not raise capital costs excessively.

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

4.0005, THERMOELECTRIC GENERATOR TESTING AND RTG DEGRADATION EVALUATION
G. Stapfer, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103

The objectives of this work are: (1) life testing of thermoelectric generators representing technologies proposed for and used in space flight RTGs to accumulate a performance base not available elsewhere; and (2) to understand the degradation mechanisms in a high-temperature selenide thermopile through materials and power module testing with the aim of formulating a model to predict its long-term behavior.

SUPPORTED BY U.S. Dept. of Energy

4.0006, CAPACITANCE AND CONDUCTANCE DEEP LEVEL TRANSIENT SPECTROSCOPY
L. Forbes, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (ENG79-11373)

An electronic measurement system is being acquired that is used to detect deep level electronic energy states in semiconductor materials. The system uses capacitance and conductance data as functions of temperature to deduce properties of the states. Surface oxide and bulk traps in gallium arsenide and silicon-on-sapphire films are being investigated with the aid of the system.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0007, SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEMS PHASE I
Unknown, Martin Marietta Corp., Denver Division, *P.O. Box 179, Denver, Colorado* 80201 (ET-78-C-03-2234)

SUPPORTED BY U.S. Dept. of Energy

4.0008, BASIC MECHANISMS INFLUENCING SOLAR CELL EFFICIENCY FOR TERRESTRIAL APPLICATIONS
F.A. Lindholm, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (EY-76-S-05-5134)

The objectives of this research are: (1) to determine and describe the basic mechanisms that control and limit solar-cell conversion efficiency; (2) to develop mathematical models that enable the inclusion of these mechanisms in the engineering design of solar cells; and (3) to explore design improvements based on the understanding gained of the basic mechanisms. By basic mechanisms are meant the mechanisms that determine the transport, recombination, and generation of electrons and holes in semiconductor material and, thereby, in large measure, determine the solar conversion efficiency. Thus the research focusses on the mechanisms that control the electronic parameters, such as lifetime and effective band gap, that characterize the transport, recombination and generation processes. It focusses also on the basic mechanisms by which such design variables as injection level, doping profile, and device structure influence these processes.

SUPPORTED BY U.S. Dept. of Energy

4.0009, ICE/FROST DETECTION USING MILLIMETER WAVE RADIOMETRY
J.A. Gagliano, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 8-33800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0010, SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBIOLOGY
W.O. Winer, Georgia Inst. of Technology, School of Mechanical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAG 3-77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0011, SYNTHESIS AND OPTIMIZATION OF SPIRAL BEVEL GEAR TOOTH SURFACES
F.L. Litvin, University of Illinois, Chicago Circle Campus, School of Engineering, Dept. of Mechanical Engineering, *Box 4348, Chicago, Illinois* 60680 (NAG 3-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0012, MECHANICAL FEASIBILITY OF THE WLVEC ENGINE
G. Steelman, WLVEC Technology Co., *310 S. 11th St., Odel, Iowa* 50003 (DE-AC05-77ET20163)

The objective is to demonstrate the technical feasibility of a drogue-chute type model ocean energy conversion system.

The contractor will build a demonstration drogue-chute type ocean energy conversion test model to assess the efficiency of mechanical power conversion and perform scaling analysis of model to prototype.

A demonstration model has been fabricated. Most of the equipment has been purchased and assembled. The Power Loop (parachutes and drive cable) is completed. The Power Extraction wheels are partially completed. Testing will follow completion.

SUPPORTED BY U.S. Dept. of Energy, Office of Solar Geothermal Electric & Storage Systems

4.0013, PHOTOVOLTAIC GAS AS CELL THERMAL STUDY
I.D. Bankston, University of Southwestern Louisiana, College of Engineering, Dept. of Mechanical Engineering, *P.O. Box 3131, Lafayette, Louisiana* 70501 (NAS 8-33765)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0014, IMAGE COLLAPSING CONCENTRATORS
S.L. Sargent, Solar Energy Technology Inc., *Bedford, Massachusetts* 01730 (EG-77-G-04-4163)

Research and development project is directed toward discovery and development of optical collectors for solar energy using novel designs of stepped (Fresnel) lens and subreflectors. The following objectives are expected to be reached: (1) lenses for concentration ratios of 3 times or more which do not require movements or tracking of sun all year around; (2) lenses constructed of flat prisms of thin cross-section and low mechanical tolerance; (3) subreflectors which will improve the aperture efficiency of lenses to 80% or better and will allow for segmented operation of concentrators at operating temperature of approximately 100 degrees C; (4) development of low-cost, thinner lens concentrators using new Image Collapsing Concentrator Concepts proprietary with Solar Energy Technology, Inc.; and (5) prototypes and testing using Laser and Solar thermal procedures will be carried out.

SUPPORTED BY U.S. Dept. of Energy

4.0015, ENGINEERING APPRAISAL OF AERODYNAMIC AND ATMOSPHERIC EFFECTS ON DRY COOLING
Unknown, Cornell University, Ithaca Campus, Graduate School, *101 Sage Graduate Ctr., Ithaca, New York* 14850 (EY-76-S-02-2924)

SUPPORTED BY U.S. Dept. of Energy

4.0016, ELECTROCHEMICAL FLUORINATION OF POLYMERIC MATERIALS FOR HIGH ENERGY DENSITY AQUEOUS AND NON-AQUEOUS BATTERY AND FUEL CELL
C.C. Liu, Case Western Reserve University, School of Engineering, Dept. of Chemical Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, DEVELOPMENT OF OPTIMIZATION TECHNIQUES FOR CONTROL OF VEHICLE STORED ENERGY AND OPTIMIZATION OF HYBRID VEHICLE PROPULSION SECTION
J.F. Donoghue, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NAG 3-84)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0018, TEST ANALYSIS TECHNIQUES
F. Ostdiek, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463680)

Develop standardized in-house analysis techniques, algorithms, computational programs, and problem-solving methods in the areas of internal aerodynamics, flow measurement, aeroelasticity, and data reduction for use on all CRF test programs.

Review present-day industry and government testing techniques and build analytical, visual, computer, and small-scale tools tailored to the specialized needs of the CRF.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, MINI-TRACKER RANGING SYSTEM
R.M. Fike, Oklahoma State University, Graduate School, *211-215 Whitehurst Hall, Stillwater, Oklahoma* 74075 (NAS 6-3103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0020, AUTOMATED DATA ANALYSIS SYSTEM IN LASER SPECKLE INTERFEROMETRY AND BOUNDARY INTEGRAL EQUATION METHODS
W.F. Ranson, University of South Carolina, School of Engineering, Dept. of Mechanical Engineering, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (NAG 3-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0021, EVALUATION OF A WIND-WHEEL ELECTRIC-POWER GENERATOR
W.B. Swim, State University & Community College System of Tennessee, Tennessee Technological Unviversity, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box 128A, Cookeville, Tennessee* 38501 (NAG 8-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0022, DEVELOPMENT OF THE MECHANICAL COMPONENT OF A HIGH PRECISION STRAIN GAGE ACCELEROMETER
F.H. Speckhart, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS10-9834)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

4.0023, DEVELOPMENT OF SYNTHETIC APERTURE RADAR DESIGN APPROACH FOR WIDE-SWATH IMPLEMENTATION
B.R. Jean, Texas A & I University, Graduate School, *W. Santa Gertrudis, Kingsville, Texas* 78363 (NAS 9-16102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0024, DEVELOPMENT OF COMPUTER MODELS FOR THE PREDICTION OF LARGE DISTORTED REFLECTOR ANTENNA CHARACTERISTICS
S.M. Moskowitz, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAG 1-63)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0025, RESIDENT RESEARCH ASSOCIATESHIP PROGRAM
Unknown, Sweet Briar College, Undergraduate School, *Sweet Briar, Virginia* 24595 (NCA 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, PRODUCT END USER ANALYSIS INCLUDING ENVIRONMENTAL, SAFETY AND RETROFIT PROBLEMS FOR MEDIUM BTU SYNTHESIS GAS
S. Proffitt, University of Alabama in Huntsville, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-33889)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0002, APPLICATIONS OF RADAR AND INFRARED AIRBORNE REMOTE SENSING TO GEOTHERMAL RESEARCH ON PILGRAM SPRINGS, ALASKA
R.B. Forbes, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NAG 9-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0003, IMPACT CRATERING EXPERIMENTS
R. Greeley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0004, INVENTORY AND CLASSIFICATION OF WINDFORMS
C.S. Breed, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02366)

Work planned for FY 79 includes: 1) Completion of the inventory and classification of martian windforms, and selection of appropriate frames to illustrate the Atlas of Martian Eolian Landforms. 2) Photographic and statistical analysis of select typical martian windforms for comparison with their terrestrial counterparts as seen on LANDSAT and high-altitude aerial pictures. 3) Compilation of an Atlas of Martian Eolian Landforms for submission as a NASA Special Publication in FY 80.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, RESEARCH IN RADAR APPLICATIONS
H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02347)

Side-looking radar images will be acquired from orbital and aircraft altitudes, using radar systems similar to those planned for future planetary missions. SEASAT images will be obtained at L-band frequency; look angle will be approximately 50 degrees. Same-side and opposite-side stereo radar images will be obtained by commercial simultaneous L-band and X-band radar systems. Interpretive geologic maps will be compiled from these

images of three areas. Geologic maps will also be compiled of the three areas from visible and IR wavelength images. Specific areas where the radar-generated map differs from the visible/IR map will be checked in the field. Conventional geologic mapping has already been completed in the areas chosen for this study; geologists responsible for the completed geologic mapping will be consulted when the field check is conducted.

Three test areas were chosen where diverse geologic units are thought to be analogous to those that will be imaged by future planetary missions, and where the most time and cost-effective studies can be conducted. Silt and sand dune patterns will be imaged and compared in the Cortez and Algadones areas. Basaltic and rhyolitic extrusive volcanic rocks, intrusive igneous rocks, and sedimentary formations will also be contrasted in the Cortez area. Lava flows, sedimentary rocks, dune fields and river channel deposits will be compared in the San Francisco volcanic field.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, SPACE SHUTTLE RADAR

G.G. Schaber, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02188)

STATE TO WHICH PROJECT PERTAINS: Arizona.

During FY 79 the project goals will be to further identify and refine techniques to obtain radar backscatter information on diverse terrain types that can be used to interpret radar images to be obtained by the Space Shuttle Radar (SIR-A experiment) during 1979. The project will also continue to provide other types of geologic support with regard to selection of terrain targets for the mission and mission operations.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0007, RADAR IMAGE PROCESSING RESEARCH

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02350)

STATE TO WHICH PROJECT PERTAINS: Arizona.

Several types of radar images of a collection of geologic targets have been or will be acquired for input to digital image processing. The radar data that have been collected include two frequencies and two different polarizations; different resolutions, azimuths and depression angles for the same frequencies and polarization. From both aircraft and SEASAT data the objectives are to investigate the following areas: 1. geometric corrections to include point perspective projections; 2. clean-up of the digital data (i.e., noise removal techniques which include bit errors, drop-lines, speckle and coherent patterns); 3. digital registration for the radar images of differing frequencies, polarizations and look directions; 4. topography enhancement; 5. radar albedo enhancement; 6. digital mosaicking of several image strips; 7. elimination of the radar shadow by using two different look directions; and 8. development of digital filters which will minimize the 'ringing' effects from high contrast images.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, GALILEO NIMS

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02238)

Provides scientific guidance and leadership in the design and fabrication of the NIMS instrument, in the design of the mission orbital sequences, and in planning ground-based data reduction and science analysis. This activity will be ongoing through 1985.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, FRAUNHOFER LUMINESCENCE

R.D. Watson, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001

STATES TO WHICH PROJECT PERTAINS: Western United States, Oklahoma, Maine, and Florida.

Laboratory measurements of the luminescence of selected gases present in natural seeps are planned to both quantify their luminescence properties and to determine their detectivity with the imaging FLD. Tank tests, using the imaging FLD suspended over the tank, will be conducted to correlate physical properties of oil (specific gravity, film thickness, weathering, etc.) and gas seeps with their luminescence properties. Luminescence images of selected sites of oil and gas seeps, as well as vegetated areas under hydrocarbon stress, will be acquired in cooperation with other federal agencies and the GEOSAT Committee.

Analysis of imagery acquired over areas of geochemically stressed vegetation, luminescent playas and uranium sandstones will proceed and will incorporate further refinements in image analysis techniques.

Additional sampling of materials in areas where FLD imagery was acquired is planned for atomic absorption and chemical analysis. Results of this analysis will permit a more accurate determination of the cause of luminescence anomalies.

A proposal to incorporate an imaging FLD in a shuttle experiment for acquiring luminescence images of selected areas on the Earth's surface from orbit altitudes will be submitted to the National Aeronautical and Space Administration (NASA).

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0010, GROUND-WATER HYDROLOGY OF THE COCONINO AQUIFER IN SOUTHERN APACHE COUNTY, ARIZONA - A MATHEMATICAL ANALYSIS

P.P. Ross, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Flagstaff, Arizona* (AZ 78-046)

Coconino aquifer will be the source of water for large ground-water withdrawals in the near future. Coronado generating plant and possible construction of a second generating plant will require additional water. Also, more water will be needed to support construction and maintenance personnel and satellite industries. Pumpage may increase by 50,000 AF within the next few years. Effects of the project pumpage are unknown because the ground-water flow system is poorly defined in part of the area.

The principal objectives are (1) to provide a preliminary estimate of the average recharge and discharge values and to difine the aquifer characteristics of that part of the Coconino aqifer that is within southern Apache County, and (2) to determine the potential effects of the projected ground-water withdrawals.

Potentiometric surface, aquifer thickness, water-level decline and aquifer characteristic data at selected points are available. Additional data required include estimates of recharge and discharge. Recharge will be estimated by a flow net analysis and discharge will be estimated on the basis of available spring-flow, stream-flow and pumpage measurements. The model will be calibrated using steady-state and transient-state techniques. When the model is calibrated the project pumpage values will be used to simulate water-level declines for the years 1985 and 2000.

The steady-state model was calibrated. The model seems to be sensitive to changes in transmissivity, which reflect the geologic structure of the area. Part of the report was written.

The transient-state model will be run to verify the steady-state calibration.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0011, STUDY OF AN OPTICAL SPECTROMETER TO MEASURE ATMOSPHERIC COMPOSITION FROM ENTRY PROBES
M.G. Tomasko, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NAG 5-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0012, INVESTIGATION OF THE CHEMICAL DYNAMICS OF THE VENUS ATMOSPHERE
G.T. Sill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAGW 67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0013, SOLAR DIAMETER MEASUREMENTS FOR STUDY OF SUN CLIMATE COUPLING
H.A. Sill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAS 5-26176)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0014, DYNAMICS OF PLANETARY ATMOSPHERES
A.P. Ingersoll, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NAGW 58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0015, DEVELOPMENT OF MATHEMATICAL TECHNIQUES FOR ASSIMILATION OF REMOTE SENSING DATA INTO ATMOSPHERIC MODELS
J.H. Seinfeld, California Inst. of Technology, School of Engineering, Dept. of Chemical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 1-71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0016, INVENTORY AND CLASSIFICATION OF VOLCANIC FEATURES
C.A. Hodges, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02359)

In FY 79, we expect to complete a preliminary survey of mosaics made from Viking orbiter photographs, with the intent of obtaining a representative sample of candidate volcanic landforms. We can then formulate a scheme for classification and cataloging such landforms so that analyses and interpretations can be conducted systematically.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0017, A PLAN TO DEFINE A PROGRAM OF BASIC RESEARCH IN UTILIZATION AND EVALUATION OF INFORMATION DERIVED FROM REMOTELY SENSED DATA
J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAS 9-16077)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0018, CREEP OF ORTHOENSTATITE AT HIGH TEMPERATURE AND LOW STRAIN RATES
C.G. Sammis, University of Southern California, School of Letters Arts & Sciences, Dept. of Geological Sciences, *3551 University Ave., Los Angeles, California* 90007 (NAGW 43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0019, A LABORATORY INVESTIGATION OF THE REFLECTIVE PROPERTIES OF SIMULATED, OPTICALLY THICK CLOUDS
T.B. McKee, Colorado State University, School of Engineering, Dept. of Atomospheric Science, *Fort Collins, Colorado* 80523 (NAG 5-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, REMOTE LASER MEASUREMENTS
L.V. Batlin, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA74278)

PROJECT OBJECTIVE: To investigate the possibilities for practical remote temperature measurements in the atmosphere on the basis of the Doppler broadening of the molecular spectrum. The basic principle is to measure the broadening of laser light scattered by molecules.

CURRENT YEAR PLAN: Operate a system which should be able to provide data which can be compared with theoretical predictions of the spectra from the lower part of the atmosphere for the effect of collective phenomena. The system is based on scanning both in height and in frequency.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0021, SOLAR X-RAY IMAGER INSTRUMENT
R. Grubb, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8B240458)

OBJECTIVE: To study the feasibility of a next-generation Solar X-Ray Imager Instrument.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0022, SUPPLEMENT TO PRE-PROFS
D. Haugen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AC44423)

OBJECTIVE: To design, develop and install an automatic data-acquisition system for observing, analyzing and displaying surface wind, temperature, moisture, and precipitation within a one-hundred-mile radius of the Boulder/Denver area.

CURRENT YEAR PLAN: To complete the installation of an automated system based on weather stations currently in existence and to display time averages of the available data at the National Weather Service Office, Denver, Colorado. Emphasis will be to exploit existing meteorological sensors within the current year.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0023, PRE-PROFS
D. Haugen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA75722)

OBJECTIVE: To design, develop, and install an automatic data-acquisition system for observing, analyzing, and displaying surface wind, temperature, moisture, and precipitation within a one-hundred-mile radius of the Boulder/Denver area.

CURRENT YEAR PLAN: To complete the installation of an automated system based on weather stations currently in existence and to display time averages of the available data at the National Weather Service Office, Denver, Colorado. Emphasis will be to exploit existing meteorological sensors within the current year.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0024, NEAR-SHORE METEOROLOGY
R.M. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (R7120848)

OBJECTIVE: As part of the OCSEAP effort, obtain a descriptive picture of the extent, magnitude, frequency and distribution of near-shore meteorological processes which contribute to the circulation and mixing of coastal waters.

CURRENT YEAR PLAN: An existing mesoscale model will be applied to each of three study areas with the resulting wind field to be analyzed in terms of forcing functions being modelled. Operational data will be collected from both synoptic scale and mesoscale instruments to obtain data in near-shore regions for verification of model output and for providing understanding of off-shore and along-shore wind variations.

PROGRESS REPORT: Wind data from several sources in the Yakutat area were collected. Several aircraft flights were made to provide large-scale near-synoptic coverage of the study area. Data indicate winds near the coast are more directional than those off-shore. The effect of the coastal range on turning coastal flow is evident.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0025, GRAVITY WAVE STUDIES
J.W. Wright, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RDJ44833)

Conduct a program of theoretical and experimental studies concerned with the effects of atmosperic gravity waves on the ionosphere and, in turn, with their effects on methods of observing the ionosphere.

SUPPORTED BY University of California

5.0026, LANDSAT AND AIRCRAFT IMAGERY FOR MINE-GROUND STABILITY EVALUATION
R.K. Rinkenberger, U.S. Dept. of Labor, Mine Safety & Health Admin., *P.O. Box 25367, Denver, Colorado* 80225

STATES TO WHICH PROJECT PERTAINS: Colorado, Utah, Wyoming, New Mexico, Kentucky, New York.

A suite of computer enhancement routines will be performed on five LANDSAT CCT's using the EROS Data Center GE-100 System. The tapes represent underground coal, limestone and salt mine sites and surface coal pits in New York, Kentucky, New Mexico, Wyoming, Utah, and Colorado. The sites have been extensively evaluated by the Mine Safety and Health Administration (MSHA) using conventional methods of imagery analysis. Initial observations using computer-aided imagery analysis, i.e., enhancement routines such as linear stretch, non-linear stretch (PFD) principle components, overview, and rationing, show promise for extending the interpretation capabilities related to mine-ground stability evaluations. The major output products from the exercise will be 35 mm slides of 90 separate images including annotated overviews, subscenes, ratios, lineaments, principal components, and composites.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0027, TREE-RING ANALYSIS OF RECENT SLIDE MOVEMENT, MANTI LANDSLIDE, UTAH
S.S. Agard, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Engineering Geology, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9550-02400)

STATE TO WHICH PROJECT PERTAINS: Utah.

The major objective of this project is to test and further develop the techniques of tree-ring analysis as applied to recent mass movements through a detailed study of the Manti landslide. This includes evaluating the effects of the most recent movement (1974 to present) of the Manti landslide on tree growth, investigating the history and nature of movement prior to 1974 using tree rings, climate records, and air-photos, and examining the relationship between climate and slide movements. Efforts in the current year will include: 1. collection of additional cores and sections from within and adjacent to the Manti landslide; 2. preliminary analysis of tree cores collected during FY 78; 3. investigation of alternative numerical, graphical, and statistical analysis techniques; 4. compilation of climate records and other supportive data; and 5. preparation of preliminary reports.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0028, REMOTE MONITORING OF SOURCE PARAMETERS FOR SEISMIC PRECURSORS
G.L. Choy, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Global Seismology, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9920-02383)

To search for and to accumulate statistics about spatial and temporal changes of waveforms and source parameters that can be associated with an imminent major earthquake.

To evaluate the effectiveness of a standardized and digitally recorded global network of seismographs as a remote monitor for these spatial and temporal changes.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0029, MOLE LAKE
B.D. Smith, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-02186)

STATE TO WHICH PROJECT PERTAINS: Wisconsin.

Ground geophysical surveys will be conducted to follow up the completed airborne geophysical survey to characterize potential areas of massive sulfide mineralization on Indian lands. New EM methods will be evaluated to determine their applicability to massive sulfide mineralization exploration. Computer contour maps of the airborne data will be constructed for use in both metallic and non-metallic mineral evaluations. IP complex resistivity surveys will be used where needed to help differentiate metallic from non-metallic conductors (e.g., sulfides versus graphites). Bore hole geophysical surveys will be used to help establish the nature of the electrical properties of the felsic volcanic units that are the host rocks for massive sulfide mineralization.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0030, RESEARCH ON THE CAUSES OF THE TEMPORAL CHANGES IN THE EARTH'S ALBEDO
H. Dhuria, University of the District of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NAG 5-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0031, KENNEDY SPACE CENTER PRECIPITATION MONITORING PROGRAM
B.C. Madsen, State University System of Florida, University of Central Florida, School of Arts & Sciences, Dept. of Chemistry, *P.O. Box 25000, Orlando, Florida* 32816 (NAS10-9841)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0032, INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGNETIC FIELDS MONITOR SATELLITE DATA
C.G. Harrison, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (NAS 5-26201)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, RESOURCE EVALUATION OF THORIUM AND ASSOCIATED HEAVY MINERAL-BEARING SAND OF THE COASTAL AREA OF GEORGIA

K. McConnell, State Geological Survey, *19 Martin Luther King Dr. S.W., Room 400, Atlanta, Georgia* 30334 (14-08-0001-G-491)

STATE TO WHICH PROJECT PERTAINS: Georgia.

Recently the Coastal Plains Commission has made an aeroradiometric map that includes the coastal area of Georgia. This project is to explore radiometric highs over beach sands for possible heavy mineral deposits. Work will be carried out by drilling holes in six areas. Heavy minerals will be separated and those samples containing more than two percent heavy minerals will be further processed for their thorium and titanium content.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0034, HAWAIIAN VOLCANISM AND ITS PLANETARY IMPLICATIONS

D.W. Peterson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Hawaiian Volcano Observatory, *Hawaii National Park, Hawaii* 96718 (9720-02162)

STATE TO WHICH PROJECT PERTAINS: Hawaii.

The planetary geology program at the Hawaiian Volcano Observatory strives to promote scientific interaction between observatory staff and researchers interested in planetary volcanism. This is accomplished through topical studies by Observatory staff and visiting planetary geologists. Plans for FY1979 include compilation of two or more comprehensive photo-atlases of Hawaiian landforms and surface features.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0035, RADAR

K.H. Shreeve, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (8AA830)

TECHNICAL OBJECTIVE: Cooperative effort to study new techniques and equipment to improve the NWS weather radar facility and its usefulness. EDL, in cooperation with the National Severe Storms Laboratory (NSSL), Norman, Oklahoma, SDO's Technique Development Laboratory (TDL), OTS, OM&O, and others, will work to improve hydrologic and meteorologic output products, communications, and to establish new equipment and technique requirements and specifications.

APPROACH: 1. Continue the joint experimental program with NSSL, OTS, and OM&O to establish an operational Doppler radar configuration and field techniques. 2. Experiment with the Signal Variability Processor (SVP) to establish the best use of pulse-to-pulse difference techniques. 3. Study state-of-the-art techniques in radar, display and communications in preparation for the procurement and operation of a next generation radar prototype facility.

PROGRESS: Signal processing, data processing, and display techniques for both conventional and Doppler radar are under investigation for possible application to new radar systems. An experimental color display system was developed for use on the National Severe Storms Laboratory's (NSSL) Doppler radar. Doppler radar's use for velocity measurements is key to providing advanced severe weather warnings, in particular for tornadoes and damaging wind situations. The Radar Data Processor (RADAP) equipment's functional design and specification was completed, and it is now in the procurement cycle. This equipment will provide the first operational automated data processing, communications and display equipment. As next generation radars become available, RADAP will be expanded and become an integral part of the system. Analysis of the operational use of SVP data has proven complicated. Additional statistical analysis hardware has been constructed and recording equipment procured to allow computer analysis, hopefully leading to a better understanding and improved use of SVP data. The success of several RADAP output products, such as rainfall accumulation, depends on the non-weather echo rejection ability of the SVP equipment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0036, AGRICULTURAL WEATHER PREDICTION - GENERAL AGRICULTURAL WEATHER GUIDANCE

G.M. Carter, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D43102)

OBJECTIVES: To develop automated techniques for prediction of weather variables of general importance to agriculture throughout the United States. These forecasts will be used primarily as guidance for NWS forecasters.

APPROACH: Techniques will be developed to combine MOS forecasts of several differing weather elements to obtain automated forecasts of agricultural parameters such as percent of possible sunshine, relative humidity, drying rates, and dew.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0037, AGRICULTURAL WEATHER PREDICTION - SPECIALIZED AGRICULTURAL WEATHER GUIDANCE

G.M. Carter, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D43101)

OBJECTIVE: To develop automated techniques for prediction of weather variables of particular importance to agriculture for several areas in the United States where agriculture is a major industry. These forecasts may be used as guidance for NWS forecasters or may be issued directly to the public.

APPROACH: We use the MOS concept to derive equations to predict elements such as air and soil temperature, precipitation, relative humidity, dew, and frost, and appropriately disseminate the resulting forecasts. The selection of weather elements and forecast areas is closely coordinated with the agricultural program leader in OM&O. Forecasts from the various operational agricultural guidance packages are carefully monitored.

PROGRESS: Five-day forecasts of maximum and minimum air temperatures and bare-ground and grassy-ground soil temperature, plus 3-day forecasts of minimum relative humidity and the probability of various amounts of precipitation are routinely transmitted to NWS forecasters in Indiana. In addition, 3-day forecasts of the probability of several intensities of ground condensation are now being developed.

Five-day forecasts of maximum and minimum air temperatures, plus 3-day forecasts of probability of precipitation amounts, are routinely transmitted to NWS forecasters in Michigan. In addition, 3-day forecasts of the probability of frost are now being developed.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0038, TERMINAL WEATHER PREDICTION - SHORT-RANGE AVIATION FORECASTING

R.G. Miller, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D590501)

OBJECTIVE: To develop and implement at AFOS field sites improved techniques to rapidly update forecasts for the weather elements required in the terminal forecast for projections in the range 0-to-12-h.

APPROACH: Locally available observations will be used in an equivalent Markov model to forecast the elements of the surface observation. The results will be compared to the results of the single station technique now used in the AFOS monitoring and updating system. Ways to incorporate the forecasts from other TDL techniques (e.g., model output on 2- to 6-h thunderstorms) into the AFOS field site short-range data base will be sought.

PROGRESS: Design of software for preparing observational data for input to Markov model on this new subtask began in July 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0039, AFOS FORECAST APPLICATION - LOCAL MONITORING AND UPDATING

D.J. Vercelli, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27021)

OBJECTIVE: To develop an automated procedure for AFOS systems at WSFO's which will monitor all surface aviation observation (SAO's) and terminal forecasts (FT's) within each WSFO's area of responsibility and (1) alert the forecaster when a problem or potential problem arises with the FT, and (2) provide objective guidance for preparing FT's.

APPROACH: AFOS system minicomputers at WSFO's will be programmed to compare each observation with the FT for that terminal and determine if a discrepancy exists with respect to: (1) official FT amendment criteria (problem), or (2) other criteria to be established (potential problem). When either condition occurs, the system will generate a message to the forecaster which will indicate the situation and provide an objective forecast of the surface weather elements. Forecasts will be produced by single station equations or, as necessary, generalized operator equations; both will use the latest observation to produce forecasts. The system will also produce guidance forecasts at any time upon request of the forecaster.

PROGRESS: All software has been converted and debugged for use on the Eclipse system. Internal acceptance testing by TDL has been completed. Forecast equations have been developed for the first 4 WSFO's implemented under AFOS and the aviation terminals under their area of responsibility.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0040, STUDIES OF PLANETARY ATMOSPHERES THROUGH OCCULTATIONS

Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 68)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

5.0041, OPTICAL TECHNIQUES FOR EARTH ROTATION MEASUREMENTS

S. Ezekiel, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF582270; F19628-79-C-0082)

AF function - weapon systems navigation and delivery. Deficiency -launch site, target position, and geoid uncertainties degrade accuracy of weapon delivery. Objective - precise, automatic rotation sensor applicable to the measurement of azimuth, latitude, rotation rate and geophysical parameters. How research contributes - contractor proposes to study optical techniques for accurately sensing the earth's rotation axis which relates to astronomic latitude, azimuth and magnetic declination.

Study optical techniques for detecting earth's rotations; primarily work will be done with a large passive ring cavity with the aim of developing techniques for both long-term geophysical research and for smaller sensors which could be used in geodetic instruments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0042, IMPROVED MICROWAVE RETRIEVAL TECHNIQUES FOR ATMOSPHERIC TEMPERATURES, WINDS AND HUMIDITY

D.H. Staelin, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 - Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0043, APPLICATION OF LASER RANGING AND VERY LONG BASELINE INTERFEROMETER DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES

S.C. Solomon, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0044, GEOPHYSICAL STUDY OF THE STRUCTURES AND PROCESSES OF THE CONTINENTAL CONVERGENCE ZONES

M.N. Toksoz, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0045, MINOR USE PESTICIDES RESEARCH, TO SUPPLEMENT THE IR-4 PROJECT (NORTH CENTRAL REGION)

R.J. Sauer, Michigan State University, Agricultural Experiment Station, Dept. of Entomology, *New Administration Bldg., East Lansing, Michigan* 48823 (0070856; MICL01235)

OBJECTIVE: To supplement the IR-4 Project effort through increasing the rate of data development (primarily efficacy, phytotoxicity and residue data) within the North Central Region's state agricultural experiment stations in order to expedite the clearance of pesticides for minor uses, principally on agricultural crops.

APPROACH: Solicit, classify and screen NC state requests for minor use pesticide clearances; secure commitments from requesting states to put out field plots necessary to collect adequate efficacy and phytotoxicity data and, where needed, generate sufficient sampling for residue analyses; provide for shipment of samples to the leader laboratory (MI AES) or the satellite laboratory (ND AES) or other laboratories as necessary; and transmit data to IR-4 Project Office for petition preparation and subsequent registration.

PROGRESS: During the period, under the direction of IR-4 Leader Laboratory program, 61 food use projects were initiated by cooperators in 9 of the North Central States (IL, IN, MI, MN, NB, OH, ND, SD, and WE). In addition, cooperators from CO and NC also submitted residue samples for projects simultaneously being conducted in the N.C. Region. Most of these field projects have been successfully completed (some were lost due to floods and other unforeseen circumstances) and the resultant residue samples submitted to the Analytical Laboratory of the Leader Laboratory and the satellite laboratory at North Dakota State University required more than 4,500 residue analyses. The field and residue results have been forwarded to IR-4 headquarters at Rutgers University and are in various stages of petition submission and review by EPA. Typical of the registrations received in the N.C. region was a Minnesota project for the use of malathion to control rice worms and maggots in wild rice.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0046, TIME VARIABLE EARTH RADIATION BALANCE MODELS AND INTERPRETATION OF SATELLITE RADIATION BUDGET MEASUREMENTS

F.L. Bartman, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (NAG 1-67)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0047, PRELIMINARY INTERFACES BETWEEN THE ORBITER AND INSTRUMENT FOR THE HIGH RESOLUTION DOPPLER IMAGER (ABBREV)
P.B. Hayes, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (NAS 5-26189)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0048, DEVELOPMENT OF ABSORPTION TECHNIQUE FOR OH MEASUREMENTS IN AMBIENT AIR
C.C. Wang, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (NAG 2-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0049, CONDUCT SHORT COURSES IN REMOTE SENSING, AS AN AID IN MINE ENGINEERING, RECLAMATION AND QUALITY CONTROL
D.J. Barr, University of Missouri, Rolla Campus, School of Engineering, Dept. of Mining Engineering, *Rolla, Missouri* 65401 (NAS13-150)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0050, CLOUD CONDENSATION NUCLEI MEASUREMENT WORKSHOP
W. Kocmond, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (NAS 8-33820)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0051, ANALYSIS OF UNIVERSITY OF NEW HAMPSHIRE ATS-6 DATA MULTIPLE SPACECRAFT STUDIES
T.E. Moore, University System of New Hampshire, University of New Hampshire, School of Life Sciences & Agriculture, Dept. of Earth Sciences, *Durham, New Hampshire* 03824 (NAGW 52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0052, RESEARCH OF PRECISE LEVELING SPACE GEODESY AND GEODYNAMICS
J.E. Oliver, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Ithaca, New York* 14850 (NAG 5-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, THE STRUCTURAL AND TECTONIC EVOLUTION OF THE NORTH ANOTOLEON FAULT
J.F. Dewey, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Geology, *1400 Washington Ave., Albany, New York* 12222 (NAG 5-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0054, CRATER MODIFICATION BY GRAVITY
H.J. Melosh, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAGW 50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0055, POPULATION STATUS OF BOBCAT AND RIVER OTTER IN NORTH CAROLINA
J.D. Hair, University of North Carolina, North Carolina State University, Agricultural Experiment Station, Dept. of Zoology, *Raleigh, North Carolina* 27600 (0078711; NC05429)

OBJECTIVE: Determine population dynamics and habits of bobcat and otter in North Carolina. Determine and evaluate state-wide bobcat and otter habitat.

APPROACH: Bobcat and otter carcasses will be collected throughout the State in association with legal trapping seasons. Animals will be aged - examination of cementum annuli. Sex ratios will be determined. Reproductive tracts of females will be examined to determine reproductive rates, estrus periods and parturition dates. Based on above data, time-specific life tables will be developed. Food habits will be determined for radio-marked individuals and parameters describing habitat preferences will be quantified and plotted on computerized habitat maps. LANDSAT imagery will be used to document state-wide habitat potentials. Population and demographic data will be used to objectively assess harvest levels compatible with annual sustained yield management strategies.

SUPPORTED BY North Carolina State Government

5.0056, MAGNETIC FIELDS MONITOR SATELLITE SCIENCE INVESTIGATION DATA AND AEROMAGNETIC DATA IN THE EASTERN PIEDMONT OF THE UNITED STATES
I.J. Won, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Geosciences, *Raleigh, North Carolina* 27607 (NAS 5-26157)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0057, INVESTIGATION OF SMALL-SCALE TERRAIN EFFECTS WITHIN CLIMATE MODELS
J.W. Deardorff, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Science, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NAG 5-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0058, COMBINED USE OF REMOTE SENSING AND SEISMIC OBSERVATIONS TO INFER RECENT CRUST DEFORMATION, ACTIVE FAULTING AND STRESS FIELDS
S.S. Alexander, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAG 5-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0059, ELECTROMAGNETIC DEEP-PROBING OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES - CONSTRAINTS ON REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES
J.F. Hermance, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAS 5-26138)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0060, STUDY OF THE EFFECTS OF CONTINENTAL WAKES
E.M. Parmentier, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAG 5-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0061, WASHINGTON DNR FOREST CLASSIFICATION
G.R. Johnson, Technicolor Graphic Services Inc., *Sioux Falls, South Dakota* 57198

STATE TO WHICH PROJECT PERTAINS: Washington.

The utility of digital analysis techniques for classifying western Washington forest lands with LANDSAT multispectral scanner (MSS) data is being investigated. The methodology for merging site-specific forest inventory data and terrain data with LANDSAT MSS data has been demonstrated.

Results of digital image processing techniques applied to LAMDSAT data will be compared to forest resource information to identify what forest resource groups can be identified with LANDSAT data. LANDSAT data will be classified into these resource groups and the classification accuracy estimated by using a simple random sampling scheme. Statistics to estimate percent correct classification as well as contingency tables which identify the nature and frequency of classification errors will be generated.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0062, TARGETING, INVENTORYING AND MONITORING GROUND-WATER RESOURCES
J.R. Lucas, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198

STATES TO WHICH PROJECT PERTAINS: South Dakota, Iowa, Wisconsin, Kansas and other locations in the Gulf Coast and High Claims.

The application of LANDSAT multispectral scanner data for targeting sources of shallow ground water in glaciated terrains is being demonstrated and documented. Conventional photo interpretation procedures are being used to delineate surficial material patterns on LANDSAT imagery of eastern South Dakota, southeastern Wisconsin, and north central Iowa. Linear and curvilinear patterns, drainage patterns, and cover type patterns have been found to relate to occurrences of pre-glacial buried valleys and landforms associated with continental glaciation. Glacial phenomena characterized by stratified sand and gravel deposits are often significant shallow aquifers. Published hydrologic and geomorphic data are being used to assess the significance of patterns distinguished on LANDSAT imagery as they relate to potential sources of ground water in glaciated terrains.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0063, WEED CONTROL IN VEGETABLES AND ORNAMENTALS AND THE EFFICIENCY OF HERBICIDES IN HORTICULTURAL SOILS
R.M. Menges, U.S. Dept. of Agriculture, Federal Research Office, Weed Control Research, *509 W. 4th St., Weslaco, Texas* 78596 (0017326; 7202-20280-001)

OBJECTIVE: Determine the effect of microclimate on the growth of weed species in vegetables and ornamentals and on herbicidal selectivity and movement and persistence in soils. Determine the feasibility of using infrared and ultra-high frequency (UHF) electromagnetic energy for weed control.

APPROACH: The herbicides glyphosate, bensulide, bromoxynil, butralin, methazole, and newly screened compounds will be applied by various soil incorporation and formulation techniques under different soil and plant microclimate conditions in cucurbit and root, bulb and cole crop vegetables and rosaceous ornamentals. Bioassays and chromatographic assays will be used to evaluate herbicidal activities. Herbicidal effectiveness, movement and persistence in soils and effect on plant growth and quality will be measured. UHF electromagnetic energy will be applied to the soil; the influence of soil texture and moisture, weed seed species, mass and moisture and depth of seed in soil will be evaluated. Weed species included will be London rocket (Simbrium irio L.), wild common sunflower (Helianthus annuus L.), and ragweed parthenium (Parthenium hysterophorus L.). The feasibility of infrared photography will be studied to remotely sense specific weed populations in crop production areas.

PROGRESS: Texas panicum, Palmer amaranth, and common purslane competed for yield of cucumber but were selectively controlled by soil-incorporated bensulide or butralin applied at planting and followed by post-emergence soil-incorporated butralin or trifluralin. Butralin persisted 11 weeks in soil to control Palmer amaranth but did not injure sorghum field-grown in rotation. Wild common sunflower populations of one plant per 7.6 cm of onion row competed for yield more than in populations of one plant per 76.2 cm of row in the first 9 weeks after emergence. The R haze (infinite reflectance) of Johnsongrass, lambsquarters and sowthistle leaves at 0.85 mm was significantly higher than sunflower, ragweed, or London rocket. Earth Resources Technology Satellite (LANDSAT-2) multispectral scanner (MSS) data were used to detect silverleaf sunflower from other plant species and to estimate its hectarage accurately.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0064, ANALYSIS OF DATA FROM THE PIONEER VENUS SOUNDER PROBE MASS SPECTROMETER
J.H. Hoffman, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (NAGW 64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0065, INTEGRATED TERRAIN MAPPING
C.J. Robinove, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092

STATE AND FOREIGN COUNTRY TO WHICH PROJECT PERTAINS: Queensland, Australia, California.

Digital images will be used to map land capability in Queensland, Australia and California, U.S.A. Terrain will be grouped into categories of land capability by the use of a statistical analysis of LANDSAT data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0066, LANDSAT IMAGE MAPS OF CAPE COD
R.S. Williams, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (E-0043)

STATE TO WHICH PROJECT PERTAINS: Massachusetts.

A variety of experimental LANDSAT image maps of Cape Cod and Cape Cod National Seashore (National Park Service) are in preparation by the U.S. Geological Survey's EROS Program. Project plans for FY 79 include: (1) the publication of a 1:250,000-scale LANDSAT image of Cape Cod in a poster format; (2) preparation of a 1:250,000-scale LANDSAT image map of Cape Cod, annotated with locations of geological and historical significance and with an extensive text; (3) preparation of an abstract on the use of LANDSAT 3 RBV images of Cape Cod to document and to delineate coast-line changes caused by the severe winter storm of 6-7 February 1978; and (4) to determine the feasibility of using LANDSAT 3 RBV images as 1:125,000-scale images bases for a geological map of Cape Cod.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0067, REMOTE SENSING AND ECOLOGICAL RESEARCH IN WETLANDS
V.P. Carter, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (NR 73-090)

Wetlands are poorly understood, hydrologically controlled environments. They are essential elements in estuarine, marine,

lacustrine, and riverine productivity. Information on (1) wetland hydrologic variables and their relation to wetland vegetation, (2) wetland dynamics and boundary fluctuations, (3) short and long term temporal changes, and (4) other ecological aspects as needed to improve our understanding of these ecosystems and to aid in classification and mapping. Wetland plants may serve as sensitive hydrologic indicators giving information on water (oxygen) stress or water quality parameters such as salinity, turbidity, pH, nutrients, or the presence of various pollutants.

To determine the spectral characteristics of wetland vegetation and relate these to interpretation of remotely sensed data. To develop improved methodology for mapping and classifying coastal and inland wetlands in cooperation with other interested government agencies and non-government groups or individuals. To examine seasonal and long-term changes in wetland ecology as related to changes in environmental parameters including hydrology, water quality, and land use. To assist with interdisciplinary studies requiring biological research and remote sensing such as the Potomac Estuary Study. To aid in the development of models that utilize remote sensing data as part of the prime data base.

Develop cooperative research projects. Cooperators include WRD Districts, TVA, Topo. Division (USGS), USFWS, NASA, JPL, interested state agencies and local groups, and others. Work with all types of remotely sensed data and available types of analysis equipment in order to achieve the best possible results in a variety of wetland studies. Assist in interdisciplinary studies by providing biological and remote sensing information that can be related to study objectives.

(1) Cooperative Project with TVA completed and final report prepared. (2) Wetland classification system for Tennessee Valley Region published. (3) Dismal Swamp Project - Map of Roads and Ditches Published, transition zone project started, additional observation wells have been installed and project revised to consider vegetative indicators. (4) Fish and Wildlife Classification System has been completed. (5) LANDSAT analysis in Alaska completed and report published. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0068, DUAL-POLARIZATION SPACE DIVERSITY MEASUREMENTS WITH THE SIRIO SATELLITE
A.H. Krebs, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NASW 3357)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0069, APPLICATION OF THE AVE-SESAME DATA SET TO MESOSCALE STUDIES
D. Suchman, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (NAS 8-33799)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0070, SUBSIDENCE OF RECLAIMED COAL MINE SPOILS, COLSTRIP, MONTANA
J.M. White, Carter Mining Co., *P.O. 209, Gillette, Wyoming* 82716 (I-0002)

STATE TO WHICH PROJECT PERTAINS: Montana.

Precise leveling surveys and ground and aerial inspections were conducted to determine the nature and practical effects of subsidence due to consolidation of reclaimed spoils at the Rosebud Mine, Colstrip, Montana. In spoils 30- to 40-years old, subsidence of spoils occurring since 1968 averages 0.1 m, and is of no practical effect. In spoils rehandled to form fill in 1968, subsidence approaches 0.25 m and is due to excessively steep side slopes, and to consolidation in response to saturation. Subsidence in areas strip mined since 1971 is as great as 0.6 m in restricted areas subject to saturation due to runoff and is apparently confined to the redistributed top-soil.

Research completed, report in preparation.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, EFFECTS OF CIRCADIAN RHYTHM PHASE ALTERATIONS ON PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES - IMPLICATIONS TO PILOT PERFORMANCE
D.C. Holley, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, EARLY EVOLUTION OF THE CYANOPHYTA
E.C. Weaver, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, PLANETARY BIOLOGY AND MICROBIAL ECOLOGY
K.H. Nealson, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (NAGW 73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0004, EXPLORATORY STUDIES OF THE RELATIONSHIP OF GASTRIC ACTIVITY AND OTHER PHYSIOLOGICAL MEASURES TO MOTION SICKNESS
J. Kamiya, University of California, San Francisco Campus, Langley Porter Neuropsychiatric Inst., Dept. of Psychiatry, *401 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, CONFERENCE ON FUNDAMENTAL ISSUES IN GLOBAL ECOLOGY
D.B. Botkin, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Biological Science, *Santa Barbara, California* 93106 (NASW 3392)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0006, MAINTENANCE OF NASA PRIMATE RESOURCES AND PRIMATE BASELINE DATA
H.M. McClure, Emory University, School of Medicine, Dept. of Pathology, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (NAS 2-10627)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, THE ROLE OF THE SYMPATHOADRENAL SYSTEM DURING EXPOSURE TO HEAT AND COLD
R.S. Elizondo, Indiana University, Bloomington Campus, School of Medicine, Dept. of Anatomy & Physiology, *Memorial Hall, Bloomington, Indiana* 47401 (NCA 2-335001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, LIFE SCIENCE FLIGHT EXPERIMENT
A. Bhattacharya, University of Kentucky, Graduate School, *Limestone & Euclid, Lexington, Kentucky* 40506 (NAS 9-16045)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0009, SPACE BIOLOGY RESEARCH PROJECT
X.J. Musacchia, University of Louisville, School of Arts & Sciences, Dept. of Biology, *129 E. Broadway, Louisville, Kentucky* 40202 (NAGW 70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0010, LIFE SCIENCE FLIGHT EXPERIMENT - FACTORS AFFECTING RESPIRATORY TRACT PARTICLE DEPOSITION AND CLEARANCE IN THE SPACE ENVIRONMENT
D.L. Swift, Johns Hopkins University, School of Hygiene & Public Health, Dept. of Environmental Health Science, *615 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 9-16036)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0011, A RESEARCH PROGRAM WITH SPECIAL EMPHASIS ON ALGAL MAT STUDIES AND MICROBIAL LIFE IN EXTREME ENVIRONMENTS
H.O. Halvorson, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAGW 72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0012, THE EFFECT OF SPACE FLIGHT ON THE GROWTH, MINERALIZATION AND REMODELING OF THE RHESUS MONKEY SKELETON
D.J. Simmons, Washington University, School of Medicine, Dept. of Surgery, *660 S. Euclid Ave., St. Louis, Missouri* 63110 (NAS 2-10636)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, SIMULATION OF WATER INFLUENCE ON MOLECULAR STRUCTURE USING AN IMPROVED MOLECULAR DYNAMICS APPROACH
J.T. Egan, State University of New York, Buffalo Campus, Graduate School, *1300 Elmwood Ave., Buffalo, New York* 14222 (NCA 2-750001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, ISOLATION AND CHARACTERIZATION OF POST-HYPOXIC HEMOLYTIC FACTORS IN BLOOD
S.A. Landaw, State University of New York, Upstate Medical Center, School of Medicine, Dept. of Medicine/Radiology, *766 Irving Ave., Syracuse, New York* 13210 (NCA 2-765001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, INERTIAL AND GEOMETRIC PROPERTY BIODYNAMIC DATA REDUCTION SYSTEM B
R.R. Rasmussen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325190)

The use of biodynamics models for the prediction of body response during impacts and other abrupt accelerations encountered in Air Force operations is a feasible complementary research approach to actual experimentation with men and animals. However, the successful and meaningful application of biodynamic mathematical models requires not only a sound formulation of model structure, but also a detailed compilation and reduction of input data describing body properties, initial positions and interactive forces. The proper formatting and specification of the input data generally is accomplished by extensive analysis and reduction of information obtained from independent experiments. The present effort is for the development of an analysis system specifically suited to the reduction of body inertial, geometric and joint-segment property data. The data output of this system will have direct application to the articulated total body (ATB) model and models of similar structure, and will provide a convenient and efficient framework for the compilation of anthropometric and body inertial data readily applicable to analysis of body dynamics and specification of body surface geometry in any given configuration.

The implementation of this system will require the addition of a color graphics terminal to an existing PDP-8A computer and the development of software for body segment data manipulation and display. The system will be interfaced with the main CDC computer at Wright-Patterson AFB to allow data transfer between the two systems. The visual system will be used to display body segment surface-defining contours, various landmarks on the surface or interiorly defined points, axes systems associated with overall segment orientation, landmarks, principal inertial moments, preferred axes of rotation of the joint and for internal force application and adjacent segment-relative orientations. This data reduction system will be specifically applied to the generation of appropriate data sets for human subjects used in impact tests at AMRL/BB, which will in turn be used with the ATB model for model validation and investigation of various test parameter variations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, BIODYNAMIC DATA BANK
Unknown, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325140)

Man's capability to function safely and effectively under the severe dynamic stresses produced by high-performance aircraft must be continually reassessed, using actual dynamic tests with human and animal subjects, measurements of body tissue properties, predictive mathematical models, and evaluations of aircraft accident causes and results. These research methods produce voluminous data which must be stored and retrieved to be used as input data for future research and to prevent duplication of effort. The objective of this work unit is to organize the diverse data from biodynamic environmental research into a unified data bank with a single computerized index, so that researchers may gain access to past and current research data stored at AMRL.

A feasibility study will be performed to identify equipment costs, environmental and power supply needs of equipment, and factors which have contributed to the success or failure of similar data bank projects. The results of the feasibility study will be used in the engineering design study for the physical plant that will house the data and data-manipulation equipment. Equipment will be installed as funds permit and data storage will begin. Concurrently, the computerized index will be developed and procedures for operating the data bank and transmitting data to the using research engineers will be devised. When operational procedures and equipment are working satisfactorily, the approach will be confined to collecting, reformatting (if necessary), indexing, and disseminating data on a continuing basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, LIFE SCIENCE FLIGHT EXPERIMENTS - DETERMINATION OF SEGMENTED FLUID SHIFTS IN HUMANS WHICH ACCOMPANY THE ONSET OF WEIGHTLESSNESS
R.J. Gowen, South Dakota School of Mines & Technology, School of Engineering, *Rapid City, South Dakota* 57701 (NAS 9-16028)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0018, PSYCHOSOCIAL CORRELATES OF MITRAL VALUE PROLAPSE

R. Ursano, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325650)

To assess psychosocial variables related to onset, worsening of symptoms, and sudden death in mitral valve prolapse (MVP).

Three patient groups will be compared for psychosocial variables related to stress - MVP group, cardiac non-MVP group, and a non-cardiac group. The MVP group will be reexamined yearly in conjunction with their USAFSAM follow-up to correlate the progression of MVP in relation to psychosocial variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0019, INFLUENCE OF WEIGHTLESSNESS - CARDIOVASCULAR EFFECT

D.L. Eckberg, Virginia Commonwealth University, Medical College of Virginia, Dept. of Medicine/Biophysics, *1200 E. Broad St., Richmond, Virginia* 23298 (NAS 9-16046)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, GRADUATE STUDENT RESEARCHERS PROGRAM SIMULATION

W.J. Karplus, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Computer Science, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 2-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, URBAN AREA CHANGE DETECTION PROCEDURES WITH REMOTE SENSING DATA

E. Maxwell, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (NAS 5-26127)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0003, MATHEMATICAL ASPECTS OF AUTOMATIC MESH GENERATION

P.R. Eiseman, Scientific Research Associates Inc., *P.O. Box 498, Glastonbury, Connecticut* 06033 (DF055720; F49620-79-C-0132)

AF function - design of aerospace and reentry vehicles. Deficiency - there is a need for an efficient technique for the automatic generation of coordinates which can be used as a framework to numerically solve modeling equations in physics and engineering. Objective - to develop and analyze a mathematical theory for automatic coordinate generation. How work contributes - the technique to be developed can be applied to aerodynamic problems with complex geometries.

The following tasks are proposed: (1) To derive and analyze the multi-surface coordinate transformation with local continuous functions applied to the associated vector field interpolation. Included in the analysis will be an examination of the distribution of coordinate curves and of the constraints on curve shapes. Also, a simple computer code to demonstrate some of the mathematical results will be written. (2) To repeat task (1) after replacing the local continuous functions with continuous functions that have continuous first derivatives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, DESIGN OF FAULT-TOLERANT COMPUTERS USING READ-ONLY MEMORIES AS BASIC BUILDING BLOCKS

D.K. Pradhan, Oakland University, Graduate School, *Rochester, Michigan* 48063 (DF055750; F49620-79-C-0119)

AF function - digital avionics systems. Important functions in growing numbers are being performed by digital computers on USAF aircraft. Deficiency - the correct functioning of the computer system is crucial since malfunctions could have catastrophic consequences for an aircraft. Such ultra-reliable computers are not yet available at affordable costs. Objective - to perfect methods for the design of fault-tolerant digital systems that use read-only memories as basic building blocks. How work contributes - the results of this research, if successful, would permit the construction of ultra-reliable computers which are essential for advanced technology aerospace vehicles.

The basic units of the planned computer architecture will be read-only memory chips. The capabilities of error-correcting codes will be exploited with the goal of achieving the required fault tolerance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

L.R. Scott, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Mathematics, *Ann Arbor, Michigan* 48104 (DF055940; F49620-79-C-0149)

AF function - the design of aerospace and reentry vehicles. The design of chemical laser devices. The study of nuclear weapons effects. Opportunity - to obtain better error bounds on the approximate solutions of the partial differential equations which model many of these design problems. Objective - to investigate maximum-norm estimates for finite element methods for certain types of partial differential equations. How work contributes - techniques may be developed which are useful in solving problems in laser and aircraft design.

The two investigators will study the following topics: (1) maximum-norm estimates for finite element methods for linear elliptic dirichlet problems and for nonlinear time-dependent problems, (2) numerical methods for the solution of some model equations for nonlinear dispersive waves, (3) spectral approximation of unbounded operators, (4) collocation-Galerkin method for nonlinear first-order hyperbolic systems, and (5) error estimates in negative order Sobolev norms for a class of finite element methods for linear first-order hyperbolic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, DATA ACQUISITION AND ANALYSIS OF A RANGE-FINDING SYSTEM FOR SPACE CONSTRUCTION

C.N. Shen, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical Engineering, *110 8th St., Troy, New York* 12181 (NAG 1-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0007, EVALUATION OF COMPUTER-AIDED RELIABILITY ESTIMATION (CARE) III

K.S. Trivedi, Duke University, Trinity College of Arts & Sciences, Dept. of Computer Science, *Durham, North Carolina* 27706 (NAG 1-70)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0008, IMPROVED ITERATIVE METHODS FOR SOLVING SPARSE SYSTEMS OF LINEAR EQUATIONS

R.S. Varga, Kent State University, School of Arts & Sciences, Dept. of Mathematics, *Hilltop Dr., Kent, Ohio* 44240 (DF056120; F49620-79-C-0175)

AF function - the design of chemical laser devices, the study of nuclear weapons effects on structures and aerospace vehicles. Deficiency - many problems in laser and nuclear phenomenology studies involve the solution of large, sparse linear

systems. Present techniques for solving such systems are not very efficient and often ineffective. Objective - to study, both theoretically and computationally, algorithms to solve iteratively large, sparse linear systems. How work contributes - algorithms to be developed may lead to useful computer codes needed at several AFSC laboratories.

One goal is to determine the exact class of all real, symmetric, positive definite, square matrices A for which A is stable for any choice of a graph G. Precise necessary and sufficient conditions for A to be stable will be pursued. Then the implicit conjugate gradient method coupled with stable factorizations will be used to solve the linear system. Also, acceleration of this technique by the block successive over-relaxation method and by the Chebyshev semi-iterative method will be investigated both theoretically and numerically. Another goal is to study symbolic methods to evaluate function-space integrals. Specifically, MACSYMA will be used to evaluate Wiener integrals. The method involves a functional Monte Carlo algorithm which will be extended to handle a variety of differential equations, including elliptic systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, INFORMATION ASSESSMENT FOR AIRBORNE C2

S. Stark, U.S. Dept. of Defense, Navy, Naval Air Development Center, Software & Computer Directorate, *Warminster, Pennsylvania* 18974 (DN081125)

Systematically develop, test and evaluate automation decision-aiding techniques, algorithms, and related man-machine interfaces to develop technology products applicable to airborne command and control systems and operations.

Establish a systematic standardized analysis methodology to identify and parameterize airborne command and control decision requirements to allow experimental demonstration/evaluation of significant automation decision-aiding algorithms and processing system configuration requirements. Perform investigation analysis to apply state-of-the-art artificial intelligence approaches to improve mission performance via automation and decision aid to human operator-decision functions. Those situations where application development of automation decision aiding would have the greatest positive impact will be identified and appropriate algorithms, man-machine interfaces, lab tests, test procedures, simulation, and validation criteria will be implemented, demonstrated and evaluated. Work will also be performed on contract under work unit ZH302 for program element 62757N, and work units AJ601B and AJ601B1.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

7.0010, DEFINITION OF THE OPERATIONAL SEMANTICS OF ADA

S. Feyock, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Mathematics & Computer Science, *Ewell Hall, Williamsburg, Virginia* 23185 (NAG 1-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0011, A NEW OBSERVER SYSTEM FOR DETERMINING ORIENTATION OF BALLOON-BORNE OBSERVATIONAL PLATFORMS

N.J. Nigro, Marquette University, School of Engineering, Dept. of Mechanical Engineering, *1515 W. Wisconsin Ave., Milwaukee, Wisconsin* 53233 (NAG 1-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, HIGH ENERGY COSMIC RAY BALLOON FLIGHT INVESTIGATIONS

J.C. Gregory, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Chemistry, *Huntsville, Alabama* 35807 (NAS 8-33975)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0002, CONTAINERLESS PROCESSING TECHNOLOGY ANALYSIS

J.E. Rush, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (NAS 8-33731)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0003, LABORATORY MEASUREMENTS AND STUDIES OF ELECTRON- MOLECULE/ATOM-COLLISION CROSS-SECTIONS

Unknown, California Inst. of Technology, Graduate School, *1201 E. California Blvd., Pasadena, California* 91109 (EN-77-S-04-4131)

SUPPORTED BY U.S. Dept. of Energy

8.0004, INTERACTION OF HIGH-POWERED LASERS WITH PLASMAS

K.A. Brueckner, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (EY-76-S-03-0034-268)

The research will be directed at the interaction of lasers with plasmas, with emphasis on the wavelength dependence on the processes of absorption and hydrodynamic energy transfer. Particular emphasis will be given to the effect of ponderomotive forces, the production of fast electrons and ions, and the coupling to the hydrodynamic implosion process. Additional studies are proposed of the effect on implosion hydrodynamics of composite shell structure.

The studies will be based on experimental data obtained by close liaison with laser programs in the U.S.A. and, as far as possible, on the programs in Europe and the U.S.S.R.

SUPPORTED BY U.S. Dept. of Energy

8.0005, RESEARCH ON LATTICE-MISMATCHED SEMICONDUCTOR LAYERS

R.L. Bell, Varian Associates Inc., Solid State Laboratory, *611 Hansen Way, Palo Alto, California* 94303

The scope of work under the contract involves growth and evaluation of alloy films on GaAs. Of immediate interest are InGaAsP layers on GaAs and studies of defects and lattice mismatch. Conduct fundamental materials research aimed at developing improved understanding of growth and properties of III-V-layered materials for solar energy applications.

SUPPORTED BY U.S. Dept. of Energy

8.0006, ELECTRON DISLOCATION INTERACTIONS AT LOW TEMPERATURES

J.M. Galligan, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Metallurgy, *Box U-37, Storrs, Connecticut* 06268 (EY-76-S-02-2305)

The following topics are being studied: electron drag on dislocations; use of superconductor-normal transition to alter electronic state; dislocation-fluxoid interactions; flow stress-field interactions in normal metals; dislocation-interstitial interactions; and Pb, Pb-Sn, Pb-Ag, Cu and Nb. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0007, THEORETICAL STUDY OF RADIATIVE INTERACTION AND ENERGY TRANSFER PROCESSES OF MOLECULAR AND ATOMIC SYSTEMS
Unknown, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001 (EY-76-S-05-4048)

SUPPORTED BY U.S. Dept. of Energy

8.0008, RESEARCH RELATIVE TO OPTICAL CONSTANTS AND PROPERTIES OF MATERIAL IN THE EXTREME ULTRAVIOLET
R.M. Catchings, Howard University, School of Liberal Arts, Dept. of Physics & Astronomy, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0009, PERFORM CERTAIN LASER FUSION RESEARCH WORK
Unknown, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228

SUPPORTED BY U.S. Dept. of Energy

8.0010, LASER FUSION RESEARCH
Unknown, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375

SUPPORTED BY U.S. Dept. of Energy

8.0011, A FUSION STUDIES PROGRAM
W.M. Stacey, Georgia Inst. of Technology, School of Nuclear Engineering, *Atlanta, Georgia* 30332 (ET-78-S-05-5683)

This project is concerned with the development of an understanding of impurity control, burn cycle dynamics and control, and reactor technological/economic trade-offs for future fusion reactors. This year, about 2/3 of the effort is devoted to work aimed at understanding the performance of a plasma in a tokamak-type fusion reactor. The remaining 1/3 of the effort is devoted to studies of the technological trade-offs in tokamak reactors. The research consists of theoretical and computer analyses.

SUPPORTED BY U.S. Dept. of Energy

8.0012, LOW-TEMPERATURE STUDIES OF DEFECTS AND SOLIDS
A.C. Anderson, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

This purpose of this project is to obtain experimental data on a variety of defect structures, both to provide a basic understanding of the defect and to permit prediction of the behavior of bulk properties when defects are present. Reduced temperatures (0.02-300 K) are used in the investigation since such data are often more amenable to theoretical interpretation and thus provide a foundation for a general theoretical development, and because some important phenomena, such as superconductivity, occur only at low temperatures. Several measurement techniques are used: thermal and electrical conductivity, specific heat, thermal expansion, ultrasonics, and dielectric polarization. Low-temperature thermal conductivity measurements, for example, provide both technical data (appropriate to cryogenic engineering application) and a source of very-high-frequency phonons to probe the dynamic response of defect structures. Three generalized classes of defects are being investigated, namely dislocations, interface and surfaces, and disordered and composite materials, including polymers and superionic conductors.

SUPPORTED BY U.S. Dept. of Energy

8.0013, EVAPORATION OF A SOLID DEUTERIUM PELLET IN A CONTROLLED THERMONUCLEAR PLASMA
J. Dorning, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Nuclear Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The evaporation rate and total penetration distance of a solid deuterium pellet after injection into a thermonuclear plasma have been studied. Detailed computer calculations in which hydrodynamics and phase transition thermodynamics are treated in a fully self-consistent manner have been done. Self-consistent shielding effects produced by the expanding evaporated material have been included. Both long-range-force energy exchanges among charged particles and short-range-force interactions between charged and neutral species have been investigated since the evaporation times of these fuel pellets are very sensitive to energy exchange mechanisms.

SUPPORTED BY U.S. Dept. of Energy, Brookhaven National Lab.

8.0014, RADIATION DAMAGE IN SOLIDS
J.S. Koehler, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

We are irradiating pure metals and semiconductors with MeV electrons at low temperatures (down to 0.5 K). The damage production and the subsequent thermal annealing are studied by measuring changes in anomalous x-ray transmission and changes in electrical resistance. We are attempting to determine the geometrical structure and the properties of interstitials, lattice vacancies, and of various clusters of defects in these materials.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0015, NUCLEAR MAGNETIC RESONANCE IN SOLIDS
C.P. Slichter, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The interests of this group are in the fundamentals of solid-state physics, including many-body problems, phase transitions, and exotic properties. At low temperatures, iron atoms in copper exhibit a phenomenon called the Kondo effect as a result of the exchange coupling of the iron atom to the conduction electrons. The explanation has challenged theorists since this is a true many-body problem. We are studying it by using ultrasensitive nuclear magnetic resonance to measure the conduction electron spin polarization which the exchange coupling produces at copper nuclei which are near neighbors to the iron atoms. In most metals, the electron charge distribution is uniform, apart from the periodic density changes arising from the presence of the nuclei. Several years ago, Overhauser proposed that in some cases the stable state would be non-uniform, i.e., there would be a charge density wave, the wavelength of which bore no relation to the lattice periodicity. Such waves have recently been found in compounds such as NbSe2 and TaS2. These materials also exhibit superconductivity, and there is speculation that the two phenomena are related. The properties of such crystals, especially emphasizing the charge density waves, are under study. A new technique has been invented for measuring electrical conductivity. The application of it to the organic conductor TTF-TCNQ has been the subject of intense study since Heeger first proposed it might be a high-temperature superconductor.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0016, SUMMER INSTITUTE IN SCIENCE AND TECHNOLOGY FOR JUNIOR HIGH SCHOOL GIRLS
O.B. Butler, Bowie State College, Graduate School, Dept. of Mathematics, *Bowie, Maryland* 20715 (NCA 5-97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0017, NUCLEAR MOMENTS AND NUCLEAR STRUCTURE
Unknown, Johns Hopkins University, Graduate School, *34th & Charles Sts., Baltimore, Maryland* 21218 (EY-76-S-02-3274)

We propose to complete the system designed to study energetic central collision of heavy ions to study the properties of nuclear matter via the emission of gamma rays. An initial study proved very successful and the group is approved for further study beginning in 1978. Follow-up studies of high-spin nuclear states resulting from pion capture are in progress and will continue in the future. High-precision data using a curved crystal spectrometer in collaboration with groups from Yale and Columbia will be carried out at Nevis as an additional program to study the excitation of nuclei via pion capture.

The experiment on the nuclear moments of beta emission is being completed and will take new directions in the future. The programs on electrons and positrons from high-energy collisions will continue. Some future experiments are also being planned for the measurement of linear polarization of gamma rays resulting from high-spin excitation of nuclei.

RESULTS: A new program studying the behavior of nuclear matter under very high excitation was begun at the Bevatron with experiments designed to study the gamma radiation emitted from central collision of heavy ions. A preliminary experiment showed the feasibility of the system and gave the first results of correlations of gamma rays with such collisions. Studies of electrons resulting from heavy-ion collisions using a special high acceptance beta spectrometer were made indicating the beginnings of effects that are complements of the so-called combined atom X-ray phenomena.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0018, THEORETICAL STUDIES OF ELECTRONIC TRANSITION LASERS
Unknown, U.S. Dept. of Commerce, National Bureau of Standards, *Gaithersburg, Maryland* 20760 (EA-77-A-01-6010-037)

SUPPORTED BY U.S. Dept. of Energy

8.0019, PLASMA PHYSICS OF PELLET FUSION
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (EY-76-S-05-5000)

Pellet fusion involves both the design of appropriate pellets and the development of a pulsed power technology (electron, ion, or laser beams) capable of igniting the pellets. We are investigating several plasma problems that arise in this field. (1) Various mechanisms are expected to generate magnetic fields in target pellets. The generation and evolution of these fields during deposition and compression are being analyzed. (2) Heavy ion beams in the 10-100 GeV range have been proposed for pellet ignition. We are developing a model for the propagation of one such focussed ion beam through the relatively dense gas that may exist in the target chamber of a reactor. Our model contains the effects of beam ion stripping, background plasma generation by the beam ions, and electron avalanching in the electric fields produced by the ion pulse. Charge and partial current neutralization, together with stability conditions and the effects of pre-ionization will be calculated. (3) The production of hard X-rays by heavy multi-GeV ions slowing down in a high atomic weight target (e.g., the outer layer of a pellet) is being calculated.

SUPPORTED BY U.S. Dept. of Energy

8.0020, NONLINEAR THEORY OF LASER PLASMA INTERACTIONS
Unknown, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (ES-77-S-05-5558)

SUPPORTED BY U.S. Dept. of Energy

8.0021, PRODUCTION ANALYSIS OF THERMONUCLEAR PLASMAS IN HIGH BETA DEVICES
H.R. Griem, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (EG-77-C-05-5307)

PURPOSE: Investigate the feasibility of fast theta pinch heating and its compatibility with confinement in a toroidal configuration with a circular cross-section for the 10/sup 13/-10/sup 15/cubic cm density regime. APPROACH: A circular cross-section torus (THOR), 40 cm minor and 1 m major diameter have been constructed. The input energy sources are six 100 kJ swinging LC generators with an initial dI/dt of 10/sup 12/ A/sec. each. A variable bias field of 0 to 1 kg can be provided. A linear fast theta pinch (FTP - 46 cm diameter, 1 m length, 30 kJ input energy, initial dI/dt equals 10/sup 12/A/sec.) is used to continue heating and diagnostic experiments in the 10/sup 12/ by 10/sup 13/ cm/sup 3/ density regime. A smaller theta pinch (STP15 cm diameter, 30 cm length, B approximately 17 kG) enables extension of investigations to densities greater than 10/sup 15/ with t/sub i/ approximately 1 keV. (ERDA 77-66)

SUPPORTED BY U.S. Dept. of Energy

8.0022, RARE GAS HALIDE LASERS FOR FUSION
Unknown, Avco Corp., Everett Research Laboratory, *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149

SUPPORTED BY U.S. Dept. of Energy

8.0023, LASER PLASMA THEORY FOR MICROWAVE MODELING EXPERIMENTS
Unknown, Avco Corp., *2385 Revere Beach Pkwy., Everett, Massachusetts* 02149

SUPPORTED BY U.S. Dept. of Energy

8.0024, DETERMINATION OF PSEUDOGAP-STATE DENSITY AND CARRIER MOBILITY IN RF-SPUTTERED AMORPHOUS SILICON
Unknown, Harvard University, Cambridge Campus, Office for Research Contracts, *10 Divinity Ave., Cambridge, Massachusetts* 02138

SUPPORTED BY U.S. Dept. of Energy

8.0025, ACTIVITIES DIRECTED TOWARD IMPROVING THE UNDERSTANDING OF THE PHYSICS OF HIGH CURRENT PULSED ELECTRON BEAMS
Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EY-76-S-02-2766)

The purpose of this program is the study of the dynamics of charged particle motions in relativistic diodes subjected to a transverse magnetic field. To date we have concentrated our investigation on cylindrical diodes acted upon by externally generated magnetic fields. The parapotential flow was unstable, as evidenced by copious microwave emission. During the coming year we propose to investigate the particle dynamics in pinched diodes in which the magnetic field is self-generated by the electron flow. Pinching will be initiated by laser generation of anode blow-off plasma. Microwave emission will be used as a diagnostic indicator of instabilities.

SUPPORTED BY U.S. Dept. of Energy

8.0026, DEVELOP AND TEST A DIGNOSTIC SYSTEM FOR SPATIAL MEASUREMENT OF ION TEMPERATURE IN HIGH TEMPERATURE PLASMAS
Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EY-76-S-02-2710)

SUPPORTED BY U.S. Dept. of Energy

8.0027, CADMIUM TELLURIDE TECHNOLOGY DEVELOPMENT
G. Entine, Radiation Monitoring Devices Inc., *444 Hunt St., Watertown, Massachusetts* 02172 (EY-76-C-02-2541)

Government-owned crystal growth and detector evaluation equipment is used to produce semiconductor materials and radiation detection devices. Funding support is primarily used for technology dissemination and reporting costs, analysis of results,

and consulting relative to CdTe detector applications. Reports, applications information and annual reports will be prepared and delivered.

SUPPORTED BY U.S. Dept. of Energy

8.0028, CHARGE TRANSFER CROSS-SECTION DETERMINATIONS IN HEAVY ION-HEAVY ION COLLISIONS
J.H. Macek, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (EG-77-S-02-4379)

Direct charge exchange between individual ions is expected to be the principal loss mechanism and limiting design factor in any heavy ion-driven inertial fusion energy production scheme. Estimates are required of the direct charge exchange cross-sections between singly ionized heavy elements in the KeV energy range. This project will use the molecular perturbed stationary state approximation method to calculate charge exchange cross-sections. The study will assess the need to take into account metastable, intermediate charge states. Results of this technique will be compared with those obtained by other procedures. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy

8.0029, FORMULATIONS ON ELEMENTARY PARTICLES INCLUDING WORK RELATED TO OBSERVATIONS ASSOCIATED WITH COSMIC RAY PHYSICS AND ASTROPHYSICS
R. Dashen, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (EY-76-S-02-2220)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0030, INELASTIC MOLECULAR COLLISIONS - APPLICATION OF THEORETICAL METHODS TO PROBLEMS RELEVANT TO LASER OPERATIONS
Unknown, Princeton University, Graduate School, *205 Nassau Hall, Princeton, New Jersey* 08540 (EY-76-S-02-2542)

SUPPORTED BY U.S. Dept. of Energy

8.0031, INVESTIGATIONS IN PLASMA DYNAMICS
Unknown, Stevens Inst. of Technology, Graduate School, *Castle Point Station, Hoboken, New Jersey* 07030 (EY-76-S-02-3004)

Analytical study of RF plasma heating in toroidal devices, nonlinear drift waves and drift waves in magnetic shear geometry. Computer-generated analytical results on parametric instabilities arising in RF heating of plasmas.

RESULTS: The modification of the drift wave spectrum by lower hybrid heating waves was studied. It was shown that zero frequency drift modes are not unstable in Tokamaks. A dispersion relation for nonlinear scattering of drift waves has been derived. Progress has been made in automating the calculation of parametric processes analytically by computer.

SUPPORTED BY U.S. Dept. of Energy

8.0032, DEVELOPMENT OF ANTENNA SPECIFICATIONS FOR THE ADVANCED SYNTHETIC APERTURE RADAR (ASAR) PROJECT
K.R. Carver, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engineering, *University Park, Las Cruces, New Mexico* 88003 (NAS 9-16092)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0033, PERFORM WORK TO CARRY OUT BRANMA CODE CALCULATIONS TO SIMULATE PLASMA LOADS FOR PROTO II ACCELERATOR
Unknown, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (EY-77-X-04-1067)

SUPPORTED BY U.S. Dept. of Energy

8.0034, NON-ADIABATIC APPROACH TO VIBRONICALLY ASSISTED RADIATIVE AND RADIATIONLESS TRANSITIONS
M. Lax, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (EG-77-S-02-4335)

A relation will be developed between the vibronically assisted radiative cross-section and that for radiationless transitions. Calculations will be made of the cross-section associated with a true multiphonon process. The method proposed will treat the nuclei classically but avoid the adiabatic approximation and will be patterned after a method due to Landau and Zener. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy

8.0035, FLUORESCENT SCATTERING BY MOLECULES EMBEDDED IN SMALL PARTICLES
P.J. McNulty, Clarkson College of Technology, School of Arts & Sciences, Dept. of Physics, *51 Main St., Potsdam, New York* 13676 (EE-77-S-02-4361)

SUPPORTED BY U.S. Dept. of Energy

8.0036, GENERATION AND FOCUSSING OF PULSED INTENSE ION BEAMS
R.N. Sudan, Cornell University, Ithaca Campus, School of Engineering, Dept. of Applied Engineering & Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (ES-77-S-02-4209)

The proposed work involves the focussing of intense ion beams in a spherical magnetically insulated diode to obtain a point focus. The ability to focus such beams by quadrupole magnetic lenses will also be examined. Improvements in the divergence of the emitted beam from the diode will be sought. Propagation and stability of the beams will be studied in low pressure gas.

RESULTS: Intense ion beams have been focussed in cylindrical, magnetically insulated diodes to a line focus at the current density of approximately 0.5 kA and a total current close to 100 kA. Intense ion beams to the order of 10 kA at a few hundred kV have been magnetically focussed by a dipole lens. It has been found that the propagation of the ion beams can be explained in terms of charged and current neutralized beams where the individual particles follow ballistic trajectories.

SUPPORTED BY U.S. Dept. of Energy

8.0037, CHARGE EXCHANGE COLLISIONS OF HIGHLY STRIPPED IONS WITH ATOMIC HYDROGEN
Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EG-77-S-02-4257)

New double tandem accelerator techniques will be used to study charge exchange of totally stripped C, N, and O ions as well as highly stripped Ni and Fe ions. The excited state content of ion beams produced by charge exchange will be investigated using kinetic energy analysis.

RESULTS: Cross-sections have been measured for partially stripped B, C, N, O, Si and Fe ion collisions with H, H2, He and Ar. Kinetic energy analysis of B3 ion produced in B4 ion-Ar collisions has been accomplished. Highly stripped ions have been decelerated to lower energies using a double tandem accelerator.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0038, STUDIES FOR THE PRODUCTION OF SUPERPURE SILICON NITRIDE
Unknown, University of Pittsburgh, Graduate School, *1028H Cathedral of Learning, Pittsburgh, Pennsylvania* 15213 (EG-77-S-02-4357)

SUPPORTED BY U.S. Dept. of Energy

8.0039, (GP-B) GRAVITY PROBE-B POINTING CONTROL AND ERROR ANALYSIS
J.C. Hung, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Electrical Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33849)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0040, MICROSTRUCTURAL STUDIES OF HYDROGEN AND DEUTERIUM IN BCC REFRACTORY METALS
S.C. Moss, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (EY-76-S-05-5111)

Hydrogen- (or deuterium-) related phenomena (lattice strain, hydride precipitation, electronic effects, Fermi surface determination, phonon dispersion) in refractory metals (V, Nb, Ta) are to be studied by using neutron scattering, X-ray diffraction, gamma-ray Compton scattering, and positron annihilation. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0041, THE INITIAL PHASES OF A TOKAMAK DISCHARGE
R.D. Bengtson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (EG-77-S-05-5615)

This experimental study will be conducted in a research Tokamak with design parameters R equals 53 cm, A equals 16 cm, B equals 10 to 20 KG, I/sub p/ equals 80 to 160 KA, T/sub e/ equals 400 eV, usable pulse length 50 msi. Emphasis will be placed on impurity transport and atomic physics studies of discharge initiation by a variety of techniques. Diagnostics to be installed on the device include 2 and 4 mm microwave Thompson scattering, and a wide variety of spectrometers.

SUPPORTED BY U.S. Dept. of Energy

8.0042, NONLINEAR MAGNETOHYDRODYNAMICS
G.M. Vahala, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (EY-76-S-05-5260)

It now seems quite natural to attain a high Beta Tokamak state by means of intense neutral beam injection. Clarke has shown that such a sequence of equilibria can be flux conserving (FCT concept). Very extensive (and non-trivial) numerical codes have been developed to study such FCT equilibria. We propose to obtain analytic solutions with nonlinear q (psi), p (psi) profiles by means of perturbation techniques. This analytic work is crucial, not only to better understand the results from the numerical codes, but because it will open the door to further analytic work on transport and stability.

The above approach and philosophy is the standard one performed in magnetic confinement studies. We believe it is of utmost importance to study non-perturbative non-linear MHD--in particular, a statistical approach to magnetic confinement. Recently, we (with Leaf Turner of LASL) have been successful in applying a statistical approach (used in fluid turbulence with periodic boundary conditions) to 3-D MHD turbulence in cylindrical geometry. We propose to apply this technique to considering the disruptive instability, magnetic island formation, transport, field reversal in toroidal z-pinches.

SUPPORTED BY U.S. Dept. of Energy

8.0043, THE PHYSICS AND CHEMISTRY OF SUPPORTED METAL CLUSTERS
J.T. Dickinson, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCA 2-840002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0044, STUDIES OF THERMONUCLEAR PLASMA EMPHASIZING PLASMA STUDIES WITH TOROIDAL MULTIPOLES
Unknown, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (EY-76-S-02-2387)

SUPPORTED BY U.S. Dept. of Energy

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, GUIDE FOR THE TEACHING AND STUDENT RESEARCH OF THE APPLICATIONS OF SHUTTLE-DERIVED SPACE UTILIZATION TECHNOLOGIES
T.S. Cheston, Georgetown University, Graduate School, *3800 Reservoir Rd. N.W., Washington, District of Columbia* 20007 (NASW 3397)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

9.0002, SAMPLING ERRORS FOR REGRESSION STATISTICS FROM COMPLEX SAMPLE DESIGNS
G. Kalton, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAS 1-16107)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, EVOLUTION OF THE CHROMOSPHERES TRANSITION REGIONS IN DWARF STARS
M.S. Giampapa, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, ULTRAVIOLET SPECTROSCOPY OF HEAVY ELEMENT ABUNDANCES IN THE NOVACE
R.E. Williams, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, RESEARCH OF THE STELLAR POPULATION OF NORMAL GALAXIES
J.G. Cohen, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-68)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, DATA REDUCTION AND ANALYSIS OF INTERPLANETARY MONITORING PLATFORM (IMP) ELECTRON ISOTOPE SPECTROMETER EXPERIMENT
E.C. Stone, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 5-25789)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, OBSERVATIONS OF SELECTED JOVIAN ATMOSPHERIC FEATURES
J.T. Trauger, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-66)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, ECLIPSE COVERAGE OF SELECTED VARIABLE AND BINARY STARS
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, STUDY OF CHROMOSPHERIC ACTIVITY IN SPECTROSCOPIC BINARY SYSTEMS
L.V. Kuhi, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0008, SPECTROSCOPIC OBSERVATIONS OF SELECTED STELLAR SYSTEMS
P.S. Conti, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astrogeophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, DISTRIBUTION AND KINEMATICS OF INTERSTELLAR GAS
W. Herbst, Wesleyan University, School of Liberal Arts & Sciences, Dept. of Astronomy, *Middletown, Connecticut* 06457 (NAG 5-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, COMETARY OBSERVATIONS WITH THE INTERNATIONAL ULTRAVIOLET EXPLORER
W.M. Jackson, Howard University, Graduate School of Arts & Sciences, Dept. of Astronomy, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-65)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0011, DEFINITION PHASE FOR TRANSITION RADIATION AND IONIZATION CALORIMETER (TRIC) TELESCOPE
D. Muller, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (NAS 5-26076)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, ULTRAVIOLET COMETARY SPECTROPHOTOMETRY
M.F. Ahearn, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 5-74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, OBSERVATION OF GLOBULAR CLUSTERS AND X-RAY BUSTERS
J.E. Grindlay, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 5-72)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0014, MULTIFREQUENCY OBSERVATIONS OF SELECTED EXTRAGALACTIC SOURCES
A.E. Glassgold, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (NAG 5-73)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0015, INVESTIGATION OF EMISSION LINE PROFILES IN TYPE 1 SEYFERT GALAXIES
S. Gregory, Bowling Green State University, School of Arts & Sciences, Dept. of Astronomy, *Bowling Green, Ohio* 43402 (NAG 5-64)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0016, DEVELOPMENT OF A HIGH RESOLUTION GAMMA RAY TELESCOPE
G.M. Frye, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NASW 3404)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0017, STUDIES OF NEW BRIGHT CHROMOSPHERICAL ACTION STARS
B.W. Bopp, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio 43606 (NAG 5-67)*

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, ULTRAVIOLET STUDY OF PECULIAR WHITE DWARFS
G.A. Wegner, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (NAG 5-60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0019, ULTRAVIOLET STUDIES OF THE COMPONENTS OF CEPHEID VARIABLES
D.H. McNamara, Brigham Young University, School of Engineering Science & Technology, Dept. of Physics, *B-166 A S B, Provo, Utah 84601 (NAG 5-62)*

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0020, SPACELAB/ULTRAVIOLET IMAGING TELESCOPE - ASTRONOMICAL INVESTIGATIONS
R.W. O'Connell, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 5-26110)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

GENERAL

11.0001, VERY LONG BASELINE INTERFEROMETER UPGRADING IMPLEMENTATION, OPERATION AND MAINTENANCE OF THE HARVARD RADIO ASTRONOMY STATION

A.E. Lilley, Harvard University, Cambridge Campus, Harvard College Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (NAS 5-25677)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

11.0002, ORGANIZATION OF THE PAPERS OF HENRY NORRIS RUSSELL

S. Weart, American Inst. of Physics Inc., *335 E. 45th St., New York, New York* 10017 (SOC78-17435)

Henry Norris Russell, possibly the most influential person in the development of modern stellar astronomy, made significant contributions to all aspects of the science during the period 1900-1950. He enjoyed a position of influence and authority in the astronomical community not equalled today. His papers will be organized, catalogued and partially microfilmed for the use of historians, philosophers and sociologists of science. An archive assistant will be employed at Princeton University Library, where the papers are located, to engage in the physical organization.

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VOLUME 18 NUMBER 23/DECEMBER 8, 1980

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N80-32323*# Michigan Univ., Ann Arbor.
INTERACTION BETWEEN A NORMAL SHOCK WAVE AND A TURBULENT BOUNDARY LAYER AT HIGH TRANSONIC SPEEDS. PART 1: PRESSURE DISTRIBUTION. PART 2: WALL SHEAR STRESS. PART 3: SIMPLIFIED FORMULAS FOR THE PREDICTION OF SURFACE PRESSURES AND SKIN FRICTION Final Report
T. C. Adamson, Jr., M. S. Liou, and A. F. Messiter Sep. 1980 136 p refs
(Grant NsG-1326)
(NASA-CR-3194) Avail: NTIS HC A07/MF A01 CSCL 02A

An asymptotic description is derived for the interaction between a shock wave and a turbulent boundary layer in transonic flow, for a particular limiting case. The dimensionless difference between the external flow velocity and critical sound speed is taken to be much smaller than one, but large in comparison with the dimensionless friction velocity. The basic results are derived for a flat plate, and corrections for longitudinal wall curvature and for flow in a circular pipe are also shown. Solutions are given for the wall pressure distribution and the shape of the shock wave. Solutions for the wall shear stress are obtained, and a criterion for incipient separation is derived. Simplified solutions for both the wall pressure and skin friction distributions in the interaction region are given. These results are presented in a form suitable for use in computer programs. Author

N80-32324# Sikorsky Aircraft, Stratford, Conn.
ADVANCED STRUCTURES MAINTENANCE CONCEPTS Final Report, Aug. 1979 - Mar. 1980
Thomas N. Cook, Michael G. Adami, Rocco R. Digenova, and David P. Maass Jun. 1980 120 p
(Contract DAAK51-79-C-0027; DA Proj. 1L1-62209-AH-76)
(AD-A087609; SER-510029; USAAVRADCOM-TR-80-D-16)
Avail: NTIS HC A06/MF A01 CSCL 11/4

A detailed R M analysis was conducted for an advanced composite rear fuselage for the UH-60A Black Hawk helicopter. Methods of improving the damage tolerance of the structure in areas of high impact exposure were evaluated. Cost effective R M options were recommended for incorporation in the design. Materials and techniques for performing rapid, low skill level repair of composite airframe structures in the Army field environment were investigated. Epoxide impregnated preform patches were evaluated for repair of primary structural components. Polyurethane foam kits were studied as a potential method of creating forms and mandrels for laminating repairs on the aircraft. A modular design concept was developed for the UH-60A composite rear fuselage. Module replacement methods were defined. Studies were conducted to assess the economics of modular maintenance versus conventional types of repair. Potential improvements in combat repairability were evaluated. GRA

N80-32325# Transportation Systems Center, Cambridge, Mass. Statistical Design and Analysis Branch.
GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY, 1978 Annual Summary Report, CY 1978
Judith C. Schwenk Mar. 1980 161 p refs Sponsored by DOT
(AD-A087653; TSC-FAA-80-6; FAA-MS-80-5) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report presents the results and a description of the 1978 General Aviation Activity and Avionics Survey. The survey was conducted during early 1979 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U.S. The survey was based on a statistically selected sample of about 13.3 percent of the general aviation fleet and obtained a response rate of 74 percent. Survey results are based upon responses but are expanded upward to represent the total population. Survey results revealed that during 1978 an estimated 39.4 million hours of flying time were logged by the 198,778 active general aviation aircraft in the U.S. fleet, yielding a mean annual flight time per aircraft of 197.7 hours. The active aircraft represented 85 percent of the registered general aviation fleet. The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use. Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours estimates. GRA

N80-32326# Arizona State Univ., Tempe. Dept. of Industrial and Management Systems Engineering.
DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL FOR AIR FORCE MAINTENANCE ORGANIZATIONS Final Scientific Report, 1 May 1979 - 15 Feb. 1980
Hewitt H. Young 1 Apr. 1980 216 p refs
(Grant AF-AFOSR-0111-79; AF Proj. 2313)
(AD-A088061; ASU-ERC-R-80016; AFOSR-80-0598TR) Avail: NTIS HC A10/MF A01 CSCL 15/5

A preliminary effort was made to generate a survey-supported model which would (1) permit periodic evaluation of the performance effectiveness of an Air Force maintenance squadron and (2) highlight equipment and human resource factors which are contributing either positively or negatively to maintenance squadron performance. The model is generated from survey data, collected from a stratified sample of maintenance technicians and their shift supervisors, and processed by means of a stepwise, linear multiple regression statistical package to provide a performance prediction equation. Factors which surface as significant in the equation indicate positive and negative contributions to squadron performance effectiveness. The modeling effort is based on studies with the 82nd Air Training Command Wing at Williams AFB and the 405th Tactical Air Command Wing at Luke AFB, both in Arizona. The model was validated using immediate supervisor ratings of maintenance technician performance in speed and quality of work, averaged across a squadron. Based on the analyses and results of studies covering two maintenance squadrons at Williams AFB and three maintenance squadrons at Luke AFB, the model provides

excellent predictions of squadron performance effectiveness and highlights significant contributing factors. GRA

N80-32327# Office of Air Force History, Washington, D. C.
THE US AIR SERVICE IN WORLD WAR I. VOLUME 3: THE BATTLE OF SAINT MIHIEL
Maurer Maurer, comp. 1979 827 p refs Prepared in cooperation with Albert F. Simpson Historical Research Center, Maxwell AFB, Ala. 3 Vol.
(AD-A088294) Avail: NTIS HC A99/MF A01 CSCL 15/7

The Battle of Saint Mihiel is of singular significance in the history of United States participation in World War I. It was the first battle in France in which an American army fought under the American flag. The U.S. offensive gained all objectives quickly and with relatively few casualties. It eliminated a menacing salient that had threatened the Allied battleline for four years, and it cleared the way for new offensive that would end the war in less than two months. Aerial operations at Saint Mihiel made the battle an important event in the history of U.S. Military aviation. It was, primarily, Col. William (Billy) Mitchell's show. He put together the largest air force ever committed to battle and drew up the plan for its employment. This volume presents documents relating to the role of U.S. aviation in the Battle of Saint Mihiel. It is the third in a series of four volumes that the Office of Air Force History is publishing on the U.S. Air Service in World War 1. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-32328*# Illinois Inst. of Tech., Chicago.
EFFECTS OF AXISYMMETRIC CONTRACTIONS ON TURBULENCE OF VARIOUS SCALES Final Report
Jimmy Tan-atichat, Hassan M. Nagib, and Robert E. Drubka Sep. 1980 376 p refs
(Grant NsG-3220)
(NASA-CR-165136; R80-1) Avail: NTIS HC A17/MF A01 CSCL 01A

Digitally acquired and processed results from an experimental investigation of grid generated turbulence of various scales through and downstream of nine matched cubic contour contractions ranging in area ratio from 2 to 36, and in length to inlet diameter ratio from 0.25 to 1.50 are reported. An additional contraction with a fifth order contour was also utilized for studying the shape effect. Thirteen homogeneous and nearly isotropic test flow conditions with a range of turbulence intensities, length scales and Reynolds numbers were generated and used to examine the sensitivity of the contractions to upstream turbulence. The extent to which the turbulence is altered by the contraction depends on the incoming turbulence scales, the total strain experienced by the fluid, as well as the contraction ratio and the strain rate. Varying the turbulence integral scale influences the transverse turbulence components more than the streamwise component. In general, the larger the turbulence scale, the lesser the reduction in the turbulence intensity of the transverse components. Best agreement with rapid distortion theory was obtained for large scale turbulence, where viscous decay over the contraction length was negligible, or when a first order correction for viscous decay was applied to the results. T.M.

N80-32329*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
CALCULATION OF THE TRANSIENT MOTION OF ELASTIC AIRFOILS FORCED BY CONTROL SURFACE MOTION AND GUSTS
A. V. Balakrishnan and John W. Edwards Aug. 1980 167 p refs
(Contract NAS4-2472)
(NASA-TM-81351; H-1125; Rept-505-36-24) Avail: NTIS HC A08/MF A01 CSCL 01A

The time-domain equations of motion of elastic airfoil sections forced by control surface motions and gusts were developed for the case of incompressible flow. Extensive use was made of special functions related to the inverse transform of Theodorsen's function. Approximations for the special cases of zero stream velocity, small time, large and time are given. A numerical solution technique for the solution of the general case is given. Examples of the exact transient response of an airfoil are presented. T.M.

N80-32330*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A CONTINUED FRACTION REPRESENTATION FOR THEODORSEN'S CIRCULATION FUNCTION
Robert N. Desmarais Sep. 1980 33 p refs
(NASA-TM-81838) Avail: NTIS HC A03/MF A01 CSCL 01A

Theodorsen's circulation function relates lift to downwash in unsteady two dimensional incompressible flow. A continued fraction representation for the circulation function is described. The continued fraction converges and has a particularly simple coefficient pattern. R.K.G.

N80-32331# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A STUDY OF TRANSIENT ABLATION OF BLUNT BODIES Ph.D. Thesis
Kazuhiro Nakahashi (National Aerospace Lab., Kakuda, Japan) Jul. 1980 29 p refs
(ISAS-581-Vol-45-No-6; ISSN-0372-1418) Avail: NTIS HC A03/MF A01

The results of a numerical approach to transient thermal response of ablating blunt bodies made of Teflon are given. A simplified thermal model was proposed to solve thermal field in the ablator having phase transition. The viscous shock-layer flow and heat conduction in the ablator were calculated using an alternately iterative scheme, and the transient thermal response of the ablating bodies is discussed in detail with emphasis on the effects of chemical reactions of the ablation products. The chemical reactions such as combustion of the ablation products in the shock layer modify characteristics of the wall heating rate significantly. The existing simple formula, which is proposed for estimating surface heating rate with reactive coolant injection, cannot predict the real heating characteristics over the ablating surface. T.M.

N80-32332*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRESSURE DATA FOR FOUR ANALYTICALLY DEFINED ARROW WINGS IN SUPERSONIC FLOW
James C. Townsend Sep. 1980 128 p refs
(NASA-TM-81835; L-13703) Avail: NTIS HC A07/MF A01 CSCL 01A

In order to provide experimental data for comparison with newly developed finite difference methods for computing supersonic flows over aircraft configurations, wind tunnel tests were conducted on four arrow wing models. The models were machined under numeric control to precisely duplicate analytically defined shapes. They were heavily instrumented with pressure orifices at several cross sections ahead of and in the region where there is a gap between the body and the wing trailing edge. The test Mach numbers were 2.36, 2.96, and 4.63. Tabulated pressure data for the complete test series are presented along with selected oil flow photographs. Comparisons of some preliminary numerical results at zero angle of attack show good to excellent agreement with the experimental pressure distributions. Author

N80-32333*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF THREE HELICOPTER ROTOR AIRFOIL SECTIONS AT REYNOLDS NUMBER FROM MODEL SCALE TO FULL SCALE AT MACH NUMBERS FROM 0.35 TO 0.90
Kevin W. Noonan and Gene J. Bingham Sep. 1980 85 p refs Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(DA Proj. 1L1-61102-AH-45)
(NASA-TP-1701; L-13139; AVRADCOM-TR-80-B-5) Avail: NTIS HC A05/MF A01 CSCL 01A

An investigation was conducted in the Langley 6 by 28 inch transonic tunnel to determine the two dimensional aerodynamic characteristics of three helicopter rotor airfoils at Reynolds numbers from typical model scale to full scale at Mach numbers from about 0.35 to 0.90. The model scale Reynolds numbers ranged from about 700,00 to 1,500,000 and the full scale Reynolds numbers ranged from about 3,000,000 to 6,600,000. The airfoils tested were the NACA 0012 (0 deg Tab), the SC 1095 RB, and the SC 1095. Both the SC 1095 and the SC 1095 RB airfoils had trailing edge tabs. The results of this investigation indicate that Reynolds number effects can be significant on the maximum normal force coefficient and all drag related parameters; namely, drag at zero normal force, maximum normal force drag ratio, and drag divergence Mach number. The increments in these parameters at a given Mach number owing to the model scale to full scale Reynolds number change are different for each of the airfoils. R.K.G.

N80-32334*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A NEW THEORY FOR RAPID CALCULATION OF THE GROUND PATTERN OF THE INCIDENT SOUND INTENSITY PRODUCED BY A MANEUVERING JET AIRPLANE

Raymond L. Barger Washington Sep. 1980 24 p refs
(NASA-TP-1733; L-13629) Avail: NTIS HC A02/MF A01 CSCL 01A

An approximate method for computing the jet noise pattern of a maneuvering airplane is described. The method permits one to relate the noise pattern individually to the influences of airplane speed and acceleration, jet velocity and acceleration, and the flight path curvature. The analytic formulation determines the ground pattern directly without interpolation and runs rapidly on a minicomputer. Calculated examples including a climbing turn and a simple climb pattern with a gradual throttling back are presented. T.M.

N80-32335*# Bihrle Applied Research, Inc., Jericho, N. Y.

ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 2: HIGH-WING MODEL C

Randy S. Hultberg and Julio Chu Oct. 1980 335 p refs
(Contract NAS1-14849)
(NASA-CR-3201) Avail: NTIS HC A15/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin g tunnel are presented in plotted form for a 1/6 scale, single engine, high wing, general aviation model. The configurations tested included the basic airplane and control deflections, wing leading edge devices, tail designs, and airplane components. Data are presented without analysis for an angle of attack range of 8 deg to 90 deg and clockwise and counter clockwise rotations covering a spin coefficient range from 0 to 0.9. Author

N80-32336# Royal Aircraft Establishment, Farnborough (England).

CONCERNING THE SEPARATED FLOW ABOUT AN INFLATING PARACHUTE

N. V. Akrushkin, A. K. Kuchugura, and N. K. Tsyganov Jun. 1980 12 p refs Transl. into ENGLISH of the book "Volnyv Sploshnykh Sredakh" Kiev, 1978 p 60-67
(RAE-Trans-2031; BR75806) Avail: NTIS HC A02/MF A01

The separated flow about an inflating canopy was modelled. The canopy geometry was approximated by a conical frustum with a hemispherical cap. The canopy envelope was replaced by a distribution of discrete vortex rings and the separated flow region was modelled by free ring vortices. The canopy pressure distribution and the mean flow velocity through the canopy vent were determined for one instant during the inflation for various vent sizes and canopy porosity values. T.M.

N80-32337*# Boeing Commercial Airplane Co., Seattle, Wash.

LARGE SCALE WIND TUNNEL INVESTIGATION FOR FUTURE MODIFICATIONS TO THE QUIET SHORT-HAUL RESEARCH AIRCRAFT

Donald N. Hultman Sep. 1980 35 p refs
(Contract NAS2-9196)
(NASA-CR-152349) Avail: NTIS HC A03/MF A01 CSCL 01A

Results of wind tunnel investigation performed to eliminate the leading edge blowing system on the baseline quiet short haul research aircraft are presented. This was accomplished by repositioning the leading edge flaps to a slotted position. Gap, overlap, and deflection angle variations were investigated. A configuration was established that satisfies QSRA performance and safety requirements. A.R.H.

N80-32338*# Lear Siegler, Inc., Santa Monica, Calif. Astronics Div.

A COMPARISON OF FLIGHT AND SIMULATION DATA FOR THREE AUTOMATIC LANDING SYSTEM CONTROL LAWS FOR THE AUGMENTOR WING JET STOL RESEARCH AIRPLANE

B. Feinreich and G. Gevaert [1980] 18 p refs
(Contract NAS2-10324)
(NASA-CR-152365) Avail: NTIS HC A02/MF A01 CSCL 01A

Automatic flare and decrab control laws for conventional takeoff and landing aircraft were adapted to the unique requirements of the powered lift short takeoff and landing airplane. Three longitudinal autoland control laws were developed. Direct lift and direct drag control were used in the longitudinal axis. A fast time simulation was used for the control law synthesis, with emphasis on stochastic performance prediction and evaluation. Good correlation with flight test results was obtained. S.F.

N80-32339*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

A CORRELATION METHOD TO PREDICT THE SURFACE PRESSURE DISTRIBUTION OF AN INFINITE PLATE OR A BODY OF REVOLUTION FROM WHICH A JET IS ISSUING Final Report, 1 Dec. 1978 - 1 May 1980

Stanley C. Perkins, Jr. and Michael R. Mendenhall Jan. 1980 200 p refs
(Contract NAS2-10125)
(NASA-CR-152345; NEAR-TR-211) Avail: NTIS HC A09/MF A01 CSCL 01A

A correlation method to predict pressures induced on an infinite plate by a jet exhausting normal to the plate into a subsonic free stream was extended to jets exhausting at angles to the plate and to jets exhausting normal to the surface of a body revolution. The complete method consisted of an analytical method which models the blockage and entrainment properties of the jet and an empirical correlation which accounts for viscous effects. For the flat plate case, the method was applicable to jet velocity ratios up to ten, jet inclination angles up to 45 deg from the normal, and radial distances up to five diameters from the jet. For the body of revolution case, the method was applicable to a body at zero degrees angle of attack, jet velocity ratios 1.96 and 3.43, circumferential angles around the body up to 25 deg from the jet, axial distances up to seven diameters from the jet, and jet-to-body diameter ratios less than 0.1. R.C.T.

N80-32340# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DYNAMIC TECHNIQUE FOR LAUNCHING STRATOSPHERIC BALLOONS WITH EXPERIMENTS WEIGHING MORE THAN 500 Kg ABOARD [TECNICA DINAMICA PARA LANCHAMENTO DE BALOES ESTRATOSFERICOS COM EXPERIMENTOS A BORDO DEMAIS DE 500 KG]

Inacio Malmonge Martin Jul. 1980 11 p refs In PORTUGUESE; ENGLISH summary Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980 Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1821-RPE/187) Avail: NTIS HC A02/MF A01

A simple launching system, spool type, fixed to the front of a truck having a special winch was developed. This was possible through the estimation of the balloon launching thrust from data tables on the gas temperature, the tube equivalent volume of water and the initial inflating pressure. A description of this technique and the results obtained in two 100,000 cu m balloon launchings are presented. T.M.

N80-32341# Payne, Inc., Annapolis, Md.
AFTERBODY DRAG. VOLUME 1: DRAG OF CONICAL AND CIRCULAR ARC AFTERBODIES WITHOUT JET FLOW Final Report
Peter R. Payne, Richard M. Hartley, and Robert M. Taylor May 1980 60 p refs
(Contract N00014-77-C-0039; WF32322203)
(AD-A087514; A125-1-Vol-1; DTNSRDC/ASED-80/10-Vol-1)
Avail: NTIS HC A04/MF A01 CSCL 20/4

A series of charts is presented which permits the determination of the base and boattail drag of conical and circular arc afterbodies. The effect of Reynolds number is considered. GRA

N80-32342# Payne, Inc., Annapolis, Md.
AFTERBODY DRAG. VOLUME 2: JET INTERFERENCE EFFECTS ON SUBSONIC BOATTAIL DRAG Final Report
Peter R. Payne Jun. 1980 74 p refs
(Contract N00014-77-C-0039; WF3232203)
(AD-A087515; A125-1-Vol-2; DTNSRDC/ASED-80/12-Vol-2)
Avail: NTIS HC A04/MF A01 CSCL 20/4

The effect of a propulsive jet on the static pressure distribution over the boattail from which it issues is discussed as well as the effect on the boattail drag. A basis is given for developing a more comprehensive analysis, provided the flow is not separated. A zero base area is assumed. GRA

N80-32343# Stevens Inst. of Tech., Hoboken, N. J.
A PROCEDURE FOR CALCULATION OF THE PRESSURE ALONG THE AXIS OF A TIP VORTEX Final Report, 10 Oct. 1977 - 30 Sep. 1978
T. V. Davies and T. P. Breslin May 1980 36 p refs
(Contract N00014-78-C-0114; SR0230101)
(AD-A087667; SIT-DL-80-9-2124) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The generation of vortical flow abreast the lateral edge and downstream of a lifting surface is examined from the basic equations of fluid mechanics using the Oseen approximation. Coupled equations which arise from matching inner and outer expansions about a conical region are derived. Their numerical solution (not attempted here) is expected to provide a more accurate prediction of the pressure distribution along the vortex axis and, hence, to a reliable prediction of inception of tip cavitation as a function of Reynolds number, and the loading on the lifting surface in the vicinity of the tip. GRA

N80-32344# Weapons Research Establishment, Adelaide (Australia).
IMPROVEMENTS TO THE NSWC AERODYNAMICS PREDICTION PROGRAM OF PARTICULAR SIGNIFICANCE FOR BOMBS
L. M. Sheppard Mar. 1980 22 p refs
(AD-A087769; WSRL-0146-TR) Avail: NTIS
HC A02/MF A01 CSCL 19/2

During use of the NSWC missile aerodynamics prediction program, a number of deficiencies have been found. Because these deficiencies are important on bombs, simple but effective corrections have been devised. Details are given of a revised expression for boattail normal force at subsonic and transonic speeds. This is necessary because the program gives normal force results that are much too large in magnitude when the base diameter is small. Also included is a correction for boattail center of pressure. In order to cope with fuses and lugs on bombs, allowances have been devised for truncated nose viscous separation pressure drag at subsonic and transonic speeds, and for excrescence drag at all speeds. The program includes an allowance for viscous separation drag at the nose shoulder, at transonic speeds. Finally, a correction has been included to account for the wave drag due to large amounts of nose blunting, including the region near the drag rise Mach number. Comparisons are made with experimental data from a number of sources, in order to show that the modified program is effective and useful. GRA

N80-32345# Engineering Analysis, Inc., Ames, Iowa.
COMPUTATION OF THREE-DIMENSIONAL SUPERSONIC VISCOUS FLOWS IN INTERNAL CORNERS Final Report, 15 Jan. 1979 - 15 Jan. 1980
John C. Tannehill and Dale A. Anderson Mar. 1980 53 p refs
(Contract F33615-79-C-3000; AF Proj. 2307)
(AD-A085857; AFWAL-TR-80-3017) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Three dimensional, supersonic viscous flows in internal corners are computed by solving the unsteady Navier-Stokes equations subject to a local conical assumption. These governing equations are solved using MacCormack's explicit finite difference scheme. A generalized coordinate system is employed which permits the grid to be refined near walls as well as in interaction regions so that viscous details can be properly resolved. Both shock fitting and shock capturing techniques are used. Two different corner flowfields are computed and the results are compared with experimental data and previous numerical solutions of the complete Navier-Stokes equations. GRA

N80-32346# Naval Research Lab., Washington, D. C. Marine Technology Div.
VORTEX SHEDDING FROM STATIONARY AND VIBRATING BLUFF BODIES IN A SHEAR FLOW Interim Report, FY 1980
Owen M. Griffin 11 Aug. 1980 43 p refs
(AD-A088083; NRL-MR-4287) Avail: NTIS
HC A03/MF A01 CSCL 20/4

If a fluid is in relative motion past a stationary bluff, or unstreamlined, structure and the vortex shedding frequency approaches one of the natural frequencies of the structure, then resonant flow-induced oscillations of the structure can occur when the damping of the system is sufficiently low. These resonant oscillations are accompanied by a 'lock-on' or capture of the vortex shedding frequency by the vibration frequency over a range of flow speeds, and this lock-on effect causes the wake and the structure to oscillate in unison. The periodic lift and the mean drag forces are amplified as a result of the vibrations, and changes in these fluid forces are closely related to the changes that occur in the flow field in the near wake of the body. Many practical ocean and wind engineering situations involve lightly damped structures that are located in flows of air or water that are nonuniform along the length of the structure. The primary difference between a uniform flow and a shear flow is the presence and added complexity, in a shear flow, of vorticity whose vector is normal to the plane of the flow. When the incident flow approaches the body this vorticity is turned into the flow direction and interacts with the vortices which are shed from the body into the wake. GRA

N80-32347# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF WINGS OF ASPECT RATIOS 3 AND 4 EQUIPPED WITH HIGH LIFT SYSTEMS
Lynn A. Trobaugh, David G. Lee, and Michael J. Harris May 1980 94 p refs
(WF41421091)
(AD-A087768; DTNSRDC/ASED-80/09) Avail: NTIS
HC A05/MF A01 CSCL 20/4

Low speed wind tunnel data show that wings of aspect ratios 3 and 4 can produce maximum lift coefficients twice that of conventional double slotted flap configurations by using powered high lift systems. These high lift systems, which utilize either the circulation control or upper surface blowing concepts, were applied to a semispan wing fuselage model having a supercritical airfoil section. GRA

N80-32348# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THEORETICAL CALCULATION OF VISCOUS-INVISCID TRANSONIC FLOWS Research and Development Report
Tsze C. Tai Aug. 1980 66 p refs Presented at the 1979 - 1980 Lecture Ser. on Shock-Boundary Layer Interaction in Turbomachines at the Von Karman Inst. for Fluid Dyn., Belgium, 2-6 Jun. 1980
(AD-A087745; DTNSRDC-80/104; DTNSRDC/AERO-1288)
Avail: NTIS HC A04/MF A01 CSCL 20/4

The current status of computational capabilities for calculating viscous inviscid transonic flows other than the solution of Navier-Stokes equations is presented. Techniques for solving transonic inviscid flows and compressible integral boundary layer methods are reviewed, and systems for strong viscous inviscid

interactions are described. Generally, the transonic viscous inviscid interaction is characterized by a subcritical boundary layer with a supersonic outer stream. The thickening boundary layer produces a pressure rise which causes further thickening of the boundary layer. The physical flow is best modeled by direct coupling of the viscous and inviscid systems to allow immediate interaction between the shock wave and the boundary layer. It appears that the method of integral relations for the outer inviscid flow, combined with an integral boundary layer scheme, possesses such a capability. To facilitate the computation, a hybrid approach to the transonic inviscid solution, which consists of the finite difference method for solving the overall transonic inviscid potential flow field and the method of integral relations for solving Euler's equation in the shock region, is suggested. Finally, the application of the steady two dimensional methods to the quasi two dimensional problem on axisymmetric stream surface of a cascade flow at transonic speeds is discussed. GRA

N80-32349# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Aerospace.
HYPERSONIC WIND TUNNEL STUDY OF A 15 DEG - 30 DEG HALF ANGLE CONCAVE BICONIC MODEL UP TO HIGH ANGLES OF ATTACK Final Scientific Report, 1 Dec. 1978 - 30 Nov. 1979
Bryan E. Richards Dec. 1979 40 p refs
(Grant AF-AFOSR-3474-78; AF Proj. 2307)
(AD-A088129; VKI-I-62) Avail: NTIS HC A03/MF A01 CSCL 16/3

Heat transfer and pressure measurements have been measured on a 15 - 30 deg half angle biconic model with a blunt nosetip in the Von Karman Institute Longshot free piston tunnel at Mach 15 and 20 Reynolds numbers between one and five million based on model base diameter. The test flow parameter closely simulated reentry aerodynamic conditions. The angle of attack of the model was varied from 0 to 20 deg. Information derived from the measurements and also schlieren pictures enabled understanding of the effects of Mach number, Reynolds number and flow incidence on the flow over the model and the location and size of heat transfer peaks. GRA

N80-32350# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
INVESTIGATION OF TRANSIENT INDUCED AERODYNAMICS IN A MOVING DECK ENVIRONMENT Final Report, Oct. 1978 - Sep. 1979
Robert E. Palmer 7 Feb. 1980 81 p refs
(WF41400000)
(AD-A088164; NADC-79260-60) Avail: NTIS HC A05/MF A01 CSCL 01/2

Operating a V/STOL aircraft in ground effect can greatly alter the aerodynamic forces and moments acting on the aircraft. By introducing a moving ground plane, such as the deck of a DD963 class destroyer, the complexity of the resulting flow field is significantly increased. This added complexity makes it even more difficult to perform successful shipboard takeoff and recovery operations. In order to fully utilize the potential shipboard operational capabilities of V/STOL aircraft a better understanding of these phenomena is required. To accomplish this, the effects of basic single axis deck motions must be examined. Analysis of these independent deck motions (heave, pitch, roll) enable the development of prediction techniques applicable to a preliminary design environment. These methods provide the designer a tool for estimating the transient induced aerodynamics acting on a V/STOL aircraft in a moving deck environment. Data for the three fan subsonic V/STOL configuration was selected for study. GRA

N80-32351# Dynamics Technology, Inc., Torrance, Calif.
FEASIBILITY STUDY OF APPLYING LAMINAR FLOW CONTROL TO AN LTA VEHICLE Final Report
Dwight J. Warner, Suphi Ozgur, and Wayne W. Haigh Apr. 1980 49 p refs
(Contract N00140-79-C-6565)
(AD-A088148; DT-7909-14; NADC-80144-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

The feasibility of applying laminar boundary-layer control with body shaping to a high altitude, Lighter-Than-Air vehicle was investigated. Solar-radiation-induced surface heating was shown to have a destablizing effect on laminar flow and caused the laminar flow to break down on regions of the vehicle surface exposed to high levels of solar radiation. Aerodynamic drag estimates were made for the vehicle. Surface waviness and roughness criteria for achieving laminar flow were determined. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-32352*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Oct. - 31 Dec. 1978
Apr. 1980 39 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-81197; A-8176; QR-10) Avail: NTIS HC A03/MF A01 CSCL 01C

Knowledge of limitations of the Air Traffic Control system in conflict avoidance capabilities is discussed. Assumptions and expectations held by by airmen regarding the capabilities of the system are presented. Limitations related to communication are described and problems associated with visual approaches, airspace configurations, and airport layouts are discussed. A number of pilot and controller reports illustrative of three typical problem types: occurrences involving pilots who have limited experience; reports describing inflight calls for assistance; and flights in which pilots have declined to use available radar services are presented. Examples of Alert Bulletins and the FAA responses to them are included. T.M.

N80-32353*# Lockheed-California Co., Burbank.
APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL, SHORT-HAUL TRANSPORT AIRCRAFT Final Report, Jun. 1979 - Jun. 1980
T. G. Coussens and R. H. Tullis Jun. 1980 203 p refs
(Contract NAS2-10264)
(NASA-CR-152363; LR-29450) Avail: NTIS HC A10/MF A01 CSCL 01C

The performance and economic benefits available by incorporation of advanced technologies into the small, short haul air transport were assessed. Low cost structure and advanced composite material, advanced turboprop engines and new propellers, advanced high lift systems and active controls; and alternate aircraft configurations with aft mounted engines were investigated. Improvements in fuel consumed and aircraft economics (acquisition cost and direct operating cost) are available by incorporating selected advanced technologies into the small, short haul aircraft. T.M.

N80-32354# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
GENERAL AVIATION ACCIDENTS: POSTCRASH FIRES AND HOW TO PREVENT OR CONTROL THEM Special Study
28 Aug. 1980 22 p refs
(NTSB-AAS-80-2) Avail: NTIS HC A02/MF A01

It was shown that postcrash fires occurred in approximately 8.0 percent of the 22,002 general aviation accidents during 1974-1978. About 59 percent of the accidents involving postcrash fire resulted in fatalities, while fatalities were involved in only 13.3 percent of those accidents without fire. It was demonstrated that feasible techniques for the containment of fuel exist. It was shown that fuel containment dramatically reduces fire injuries and deaths. It was shown that there are few regulations dealing with the postcrach fire problem in general aviation aircraft. Six recommendations to the Federal Aviation Administration for corrective action are given. T.M.

N80-32355# Battelle Columbus Labs., Ohio.
EVALUATION OF SAFETY PROGRAMS WITH RESPECT TO THE CAUSES OF GENERAL AVIATION ACCIDENTS: VOLUME 1: TECHNICAL REPORT
T. M. Connor and C. W. Hamilton May 1980 221 p refs
(Contract DOT-FA78WA-4159)
(AD-A087685; FAA-ASP-80-2-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01/2

The objective of this study was to determine the extent to which the FAA safety programs were aligned with the causes of general aviation accidents. The data base used in this study consisted of a total of 30,592 general aviation accident records compiled by the National Transportation Safety Board (NTSB) from 1971 through 1977. Analysis of these records was made with respect to NTSB-cited cause/factors. FAA programs implemented during the study time period and pertaining to safety were also included in this study. GRA

N80-32356# Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Inst.
AIRCRAFT CRASHWORTHINESS STUDIES: FINDINGS IN ACCIDENTS INVOLVING AN AERIAL APPLICATION AIRCRAFT
William R. Kirkham, James M. Simpson, Terry F. Wallace, and Paula M. Grape Apr. 1980 44 p refs
(AD-A084619; FAA-AM-80-3) Avail: NTIS HC A03/MF A01 CSCL 01/2

Aircraft crashworthiness features are presented. Modern aerial application aircraft are recognized as being the most crashworthy in the civil aviation fleet. Eighteen accidents involving an aerial application aircraft are presented. Crashworthiness is the protection by the aircraft against injury to the pilots from impact forces. The cockpit afforded good protection but in many of the accidents pilot restraint systems failed. There were no failures in lap belts or lap belt attachments. The structural attachment of the shoulder harness failed in a rare accident and the manufacturer strengthened the attachment. In three aircraft the inertia reel, to which the shoudler harness was attached, failed, diminishing the effectiveness of the shoudler harness in attenuating impact forces on the pilots. In 14 of the 18 accidents the seat completely or partially separated from the seat track, and in 14 accidents one or more of the cast alloy seat legs or pedestals broke. T.M.

N80-32357# Calspan Advanced Technology Center, Buffalo, N.Y.
ADVANCED RESTRAINT SYSTEM MODELING Final Report, Apr. 1978 - Nov. 1979
Frank E. Butler and John T. Fleck May 1980 176 p refs
(Contract F33615-78-C-0516; AF Proj. 7231)
(AD-A088029; CALSPAN-6306-V-1; AFAMRL-TR-80-14) Avail: NTIS HC A09/MF A01 CSCL 01/2

The Articulated Total Body (ATB) model is currently being used by the AFAMRL to study the biomechanics of the pilot seat ejection from an aircraft. The new ATB-II model presented in this report incorporates features developed since the original ATB model completion and new mathematical algorithms designed to improve the usefulness and correct some of the deficiencies of the model. The new features developed for this research program are a new harness belt system, rate dependent force producing functions, arbitrary specification of the motion of multiple segments and the computation of the initial orientation from orthogonal projections of the segment axes. GRA

N80-32358# Simula, Inc., Tempe, Ariz.
AIRCRAFT CRASH SURVIVAL DESIGN GUIDE. VOLUME 4: AIRCRAFT SEATS, RESTRAINTS, LITTERS, AND PADDING Final Report, Sep. 1977 - Feb. 1980
S. P. Desjardins and D. H. Laananen Jun. 1980 275 p refs Revised 5 Vol.
(Contract DAAJ02-77-C-0021; DA Proj. 1L1-62209-AH-76)
(AD-A088441; TR-7822-Vol-4; USARTL-TR-79-72D) Avail: NTIS HC A12/MF A01 CSCL 01/2

This five volume document has been assembled to assist design engineers with the development of crashworthy U.S. Army aircraft. The five volumes of the Aircraft Crash Survival Design Guide cover the following topics: Volume 1 - Design Criteria and Checklists; Volume 2 - Aircraft Crash Environment and Human Tolerance; Volume 3 - Aircraft Structural Crashworthiness; Volume 4 - Aircraft Seats, Restraints, Litters, and Padding; Volume 5 - Aircraft Postcrash Survival. This volume (Volume 4) contains information on aircraft seats, litters, personnel restraint systems, and hazards in the occupant's immediate environment. Requirements for design of seats, litters, and restraint systems are discussed, as well as design principles for meeting these requirements and testing for verification that the systems perform as desired. Energy absorbing devices for use in seat are described, as are various types of cushions. Delethalization of cockpit and cabin interiors is discussed, including the use of protective padding and the design of controls for prevention of injury. Finally, computerized methods of analysis for evaluation of seats, restraints, and the occupant's immediate environment are presented. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-32359* National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERFEROMETRIC LOCATING SYSTEM Patent
Peter F. MacDoran, inventor (to NASA) (JPL) Issued 29 Jul. 1980 10 p Filed 31 Aug. 1978 Supersedes N79-10039 (17 - 01, p 0006) Sponsored by NASA
(NASA-Case-NPO-14173-1; US-Patent-4,215,345; US-Patent-Appl-SN-938581; US-Patent-Class-343-112R) Avail: US Patent and Trademark Office CSCL 17G

A system is described for determining the position of a vehicle or other target that emits radio waves and which is of the type that senses the difference in time of arrival at spaced ground stations of signals from the vehicle to locate the vehicle on a set of intersecting hyperbolas. A network of four ground stations detects the radio emissions from the vehicle and by means of cross correlation derives the relative signal delay at the ground stations from which the vehicle position is deduced. Because the signal detection is by cross correlation, no knowledge of the emission is needed, which makes even unintentional radio noise emissions usable as a locator beacon. By positioning one of the four ground stations at an elevation significantly above the plane of the other three stations, a three dimensional fix on the vehicle is possible.
Official Gazette of the U.S. Patent and Trademark Office

N80-32360# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AZIMUTH OBSERVABILITY ENHANCEMENT DURING INS IN-FLIGHT ALIGNMENT
Itzhack Y. Bar-Itzhack and Boaz Porat Apr. 1979 32 p refs (TAE-362) Avail: NTIS HC A03/MF A01

The questions whether an axial acceleration maneuvor is superior to a lateral one during the in flight alignment (IFA) of an inertial navigation system (INS) and whether there exists a simple test or an expression which clearly indicates it are addressed. An axial maneuver is not superior to a lateral one in general. There are, however, three classes of alignment problems in which axial maneuver is superior. These cases are modeled by simple models which yield analytic expressions clearly indicating the superiority of the axial maneuver during IFA of an INS. These three classes of alignment problems encompass a large number of existing systems. T.M.

N80-32361*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT PERFORMANCE OF THE TCV B-737 AIRPLANE AT MONTREAL/DORVAL INTERNATIONAL AIRPORT, MONTREAL, CANADA, USING TRSB/MLS GUIDANCE
William F. White and Leonard V. Clark Sep. 1980 36 p refs

(NASA-TM-81885) Avail: NTIS HC A03/MF A01 CSCL 17G

The NASA terminal configured vehicle B-737 was flown in support of the world wide FAA demonstration of the time reference scanning beam microwave landing system. A summary of the flight performance of the TCV airplane during demonstration automatic approaches and landings while utilizing TRSB/MLS guidance is presented. The TRSB/MLS provided the terminal area guidance necessary for automatically flying curved, noise abatement type approaches and landings with short finals. A.R.H.

N80-32362*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PRELIMINARY EVALUATION OF TIME AND DISTANCE SPACING CUES USING A COCKPIT DISPLAYED TARGET

James R. Kelly Aug. 1980 24 p refs

(NASA-TM-81794) Avail: NTIS HC A03/MF A01 CSCL 17G

A simulator evaluation was conducted to compare time and distance selfspacing cues wherein a pilot establishes and maintains separation from a cockpit displayed target. Langley's terminal configured vehicle simulator which represents an advanced aircraft employing cathode ray tubes for primary flight displays and highly augmented flight control modes was used. Three tasks, two in trail rendezvous tasks (target straight and level and target turning) and one merge task were utilized. Three pilots flew each task twice, once with a time predictor cue and once with a distance predictor. Both time and distance spacing methods are operationally acceptable to the pilots. A slight preference was indicated by the pilots for the distance based predictor in performing rendezvous and merging tasks. Analysis of the recorded data showed the spacing performance with both predictors was essentially the same. R.K.G.

N80-32363*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SHUTTLE OFT LEVEL C NAVIGATION REQUIREMENTS: ON-ORBIT

Sep. 1980 241 p Revised

(NASA-TM-82205; JSC-14713; Rept-79-FM-10-Rev-2) Avail: NTIS HC A11/MF A01 CSCL 17G

Level C detailed requirements for the orbital operations computer loads, OPS 2 and OPS 8 are provided. These requirements represent the total on-orbit rendezvous navigation baseline requirements for the on-orbit rendezvous navigation sequencer, the on-orbit rendezvous UPP sequencer, the on-orbit rendezvous navigation, the on-orbit prediction, and the on-orbit user parameter processing function. The landing site update function requirements are also given. T.M.

N80-32364*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COMBINATIONS OF 148 NAVIGATION STARS AND THE STAR TRACKER

R. Duncan Sep. 1980 76 p ref

(NASA-TM-82203; JSC-16790; Rept-80-FM-43) Avail: NTIS HC A05/MF A01 CSCL 17G

The angular separation of all star combinations for 148 nav star on the onboard software for space transportation system-3 flight and following missions is presented as well as the separation of each pair that satisfies the viewing constraints of using both star trackers simultaneously. Tables show (1) shuttle star catalog 1980 star position in M 1950 coordinates; (2) two star combination of 148 nav stars; and (3) summary of two star-combinations of the star tracker 5 deg filter. These 148 stars present 10,875 combinations. For the star tracker filters of plus or minus 5 deg, there are 875 combinations. Formalhaut (nav star 26) has the best number of combinations, which is 33. A.R.H.

N80-32365# Committee on Government Operations (U. S. House).

FAA'S COLLISION-AVOIDANCE PROGRAM

Washington GPO 1979 495 p Hearings before the Subcomm. of the Comm. on Govt. Operations, 95th Congr., 2nd Sess., 7-8 Dec. 1978

(GPO-40-611) Avail: Committee on Government Operations

The hearings of the House Subcommittee on Government Operations investigating the actions of the Federal Aviation Administration to correct deficiencies in the air traffic control system are presented. Testimony is given regarding the development and capabilities of electronic anticollision devices and systems including the discrete address beacon system and proximity warning indicators. In addition existing air traffic control procedures are examined, and specific reference is made to the air tragedy at San Diego on Sept. 25, 1978. M.G.

N80-32366# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COOPERATIVE ESTIMATION OF TARGETS BY MULTIPLE AIRCRAFT M.S. Thesis

Ralph S. Bryan Jun. 1980 331 p refs

(AD-A085799; AFIT/GE/EE/80-5) Avail: NTIS HC A15/MF A01 CSCL 17/7

A cooperative estimator of aerial target motion was designed to combine tracking information from two cooperating fighter aircraft that are tracking a single aerial target in either range and angle, or in angle only. The cooperation occurs when information, in the form of raw measurements or state estimates, is transferred between aircraft via a telemetry link. Necessary information about attackers' relative position and orientation was assumed error free, transmission delays and other details of a data link were not included, tracker errors were modeled as white noise, and timing and word length constraints of actual real time filter software were not addressed. S.F.

N80-32367# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.

DISCRETE ADDRESS BEACON SYSTEM (DABS) FRONT END PROCESSOR EN ROUTE CENTRAL COMPUTER COMPLEX PROTOCOL Final Report

11 Apr. 1980 17 p refs

(AD-A085482; FAA-RD-80-37) Avail: NTIS HC A02/MF A01 CSCL 17/7

The Discrete Address Beacon System (DABS) was devloped as an evolutionary replacement for the current Air Traffic Control Radar Beacon System (ATCRBS). The DABS sensor, singly and in cooperation with other DABS sensors, provides surveillance of, and two way digital communications with aircraft equipped with DABS transponders, and provide surveillance of ATCRBS equipped aircraft. Surveillance data and data link services is provided via suitable land lines to Air Traffic Control (ATC) facilities (terminal and en route). The DABS/ATC interface consists of two digital links to each facility: a two way communications link and a one way surveillance link from sensor to ATC. The Common ICAO Data Interchange Network (CIDIN) protocol is used on the two way communications data link. When DABS is interfaced to an en route ATC facility, a special device, called the front end processor (FEP) is used to perform translation between the CIDIN protocol and the protocol used by the en route Central Computer Complex (CCC). The protocol to be used between the FEP and en Route CCC is defined. J.M.S.

N80-32368# Systems Control, Inc., Palo Alto, Calif.

AIRBORNE RADAR APPROACH FLIGHT TEST EVALUATING VARIOUS TRACK ORIENTATION TECHNIQUES Final Report

Larry D. King Jun. 1980 195 p refs

(Contract DOT-FA79WA-4293)

(AD-A088426; FAA-RD-80-60) Avail: NTIS HC A09/MF A01 CSCL 17/7

This comprehensive report presents the results of a flight test experiment of an Airborne Radar Approach (ARA) System utilizing various track orientation techniques and operational modes. The tests were performed in the immediate area of NAFEC in Atlantic City, N.J. The test environment involved the airport terminal area and offshore sites. The test aircraft was a NASA CH53A helicopter manufactured by Sikorsky Aircraft and currently based at NAFEC. The test period was from January 1979 to February 1979 and from June 1979 to August 1979. Flight tests for ARA accuracy and procedures development were performed in six distinct operational modes. These were as follows: beacon w/cursor, multiple beacon, skin paint, skin paint w/cursor, combined and beacon-only modes. The specific program objectives can be summarized as follows: (1) to evaluate the ability of the

radar operator to guide an aircraft along a predetermined path using various track orientation techniques, namely: the cursor and multiple beacon techniques; (2) to assist the FAA in developing and certifying standard ARA procedures and weather minimums; (3) to define and quantify specific ARA system functions and characteristics for use in a Minimum Operational Performance Standards (MOPS) document. GRA

N80-32369# Transportation Systems Center, Cambridge, Mass.
LORAN-BASED BUOY POSITION AUDITING SYSTEMS: ANALYTICAL EVALUATION Final Report, Feb. - Dec. 1979
Joseph A. Wolfson, Peter D. Engels, Martin C. Poppe, Jr. (Cambridge Engineering, Vt.), James M. Foltz (Analytical Sciences Corp., Reading, Mass.), and Leon M. DePalma Feb. 1980 256 p refs
(AD-A088266; TSC-USCG-80-2; USCG-D-09-80) Avail: NTIS HC A12/MF A01 CSCL 17/7

An analytic evaluation and comparison of the following candidate Buoy Position Auditing System (BPAS) configurations is presented in this report: transmission of digital Time Difference (TD) data from a Loran-C receiver on the buoy, retransmission of Loran-C pulses from the buoy, and combination of helicopter Loran-C data and helicopter to buoy microwave ranging data in a variable geometry solution. The candidate BPAS configurations utilize Loran-C in the differential mode. A model is developed to characterize differential Loran-C errors, accounting for the expected effect of the land/sea water conductivity interface. The error model is utilized alone, or with a microwave ranging system error model, to estimate buoy position fix accuracy afforded by each BPAS configuration. Accuracy estimates and data on cost, complexity, and technical risk are employed to recommend a BPAS configuration for testing. It is concluded that Loran-C pulse retransmission is not a viable BPAS configuration. The variable geometry BPAS configuration is highly accurate, due to calibration of Loran-C errors by processing of redundant data, but is not presently cost effective. The digital TD transmission BPAS configuration is recommended for testing, due to its simplicity and low cost. GRA

N80-32370# Naval Research Lab., Washington, D. C. Space Systems Div.
GPS NAVSTAR-4 AND NTS-2 LONG TERM FREQUENCY STABILITY AND TIME TRANSFER ANALYSIS Interim Report
J. A. Buisson, T. B. McCaskill, O. J. Oaks, M. M. Largay, and S. B. Stebbins 30 Jun. 1980 32 p refs
(AD-A088092; NRL-8419) Avail: NTIS HC A03/MF A01 CSCL 17/7

Since the launch of the first Navigation Technology Satellite (NTS) in 1974, international time transfer experiments have been performed as part of the concept validation phase of the Global Positioning System (GPS). Time transfer results from both NTS-1 and NTS-2 are presented, including recent measurements from receivers located in South America, Germany, Japan, and the United States. A time link to the DOD Master clock allows submicrosecond intercomparison of UTS (USNO, MC1) with clocks in the respective countries via the NTS link. Work is progressing toward a retrofit conversion of existing NTS receivers (located at NASA and foreign observatories) into GPS time transfer receivers. Initial results are presented on the long term rubidium frequency stability as measured from the GPS NAVSTAR-4 space vehicle (SV). Analysis has been performed for sample times varying from 1 to 10 days. Using a 154 day data span starting on day 36, 1979, data was collected from the four GPS monitor stations located at Vandenberg, Guam, Alaska, and Hawaii. A time domain estimate for the NAVSTAR-4 SV clock offset is obtained for each SV pass over the GPS monitor sites, using a smoothed reference ephemeris, with corrections for ionospheric delay, tropospheric delay, earth rotation, and relativistic effects. Conversion from the time domain to the frequency domain is made using the two sample Allan Variance; sigma tau plots are used to identify the noise processes. Estimates of flicker and white frequency noise for the NAVSTAR-4 rubidium frequency standard are obtained. GRA

N80-32371# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALTERNATE WAVEFORMS FOR A LOW-COST CIVIL GLOBAL POSITIONING SYSTEM RECEIVER Final Report, Aug. 1979 - Apr. 1980
Herman F. Vandevenne and Edward J. Kelly Jun. 1980 128 p refs
(Contract DOT-TSC-RA-78-06)
(AD-A088345; ATC-86; FAA-EM-79-16; TSC-FAA-79-24) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report examines the technical feasibility of alternate waveforms to perform the GPS functions and to result in less complex receivers than is possible with the GPS C/A waveform. The approach taken to accomplish this objective is (a) to identify, after a quick broad overview, a few promising waveforms, (b) to complete the architectural synthesis of a GPS system based on the new waveforms, (c) to analyze the performance of these systems in providing ranging and communication capability and (d) to assess the impact on receiver hardware and software. One conclusion is that the class of pulsed waveform, when combined with emerging matched filter technology, permits the use of a greatly simplified receiver design. A major part of the report consists of description of a pulse based GPS design. Although very specific, the design was intended as a vehicle for performance analysis only and many refinements and alternatives within the same class are possible. Other classes of waveforms such as tone ranging and chirped FM waveforms, although adequate, do not seem superior to the present PN encoded CW waveform for GPS. Finally, if the 'alternate' waveform is simply the present C/A waveform but with a substantially increased power level, it is shown that with the present designs the performance will be greatly increased or, alternatively, performance margin can be traded for a simplified receiver implementation. GRA

N80-32372# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
INITIAL DATA BANK REPORT: FALL 1978; WINTER, SPRING, SUMMER, FALL 1979, WINTER 1980 Data Report, 1978 - 1980
Lorraine I. Rzonca Jul. 1980 22 p
(AD-A088204; FAA-CT-80-189; FAA-RD-80-83) Avail: NTIS HC A02/MF A01 CSCL 17/7

The International Bank for airborne Omega data has begun operation at the Federal Aviation Administration (FAA) Technical Center. This first report issued by the Data Bank is based upon preliminary data for Pacific flights in fall 1978 and winter/spring 1979 and upon data from North Atlantic flights in summer/fall 1979 and winter 1980. At least three Omega stations were received during all phases of these flights. No significant seasonal variations or effects due to solar activity were noted in the signal to noise values. These values were highly repeatable (under the same conditions) with major drops due to ice cap attenuation and operation in areas of normally high very low frequency (VLF) noise. Differences in signal to noise between signals traversing daylight/night ice cap (for both Greenland and Antarctica) were noted. GRA

N80-32373# Federal Aviation Administration, Atlantic City, N.J.
SYSTEM DESCRIPTION FOR THE AIRBORNE-OMEGA DATA BANK
Lorraine I. Rzonca Jul. 1980 34 p refs
(AD-A087606; FAA-CT-80-191; FAA-RD-80-84) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Airborne-Omega Data Bank has been established at the Federal Aviation Administration (FAA) Technical Center. Its main objective is to provide a centralized repository for operational airborne-Omega data so that performance which is representative of the majority of production airborne-Omega navigation equipments under various ionospheric conditions (including high solar activity) may be evaluated. Details of the methods developed for data collection, processing, and reporting are documented in this report. Current status and plans for the near future are discussed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-32374# Sikorsky Aircraft, Stratford, Conn.
ADVANCED STRUCTURES CONCEPTS R AND M/COST ASSESSMENTS Final Report, Oct. 1977 - Feb. 1979
Thomas N. Cook Sep. 1979 237 p refs
(Contract DAAJ02-77-C-0061; DA Proj. 1L2-62209-AH-76)
(AD-A077373; SER-510016; USARTL-TR-79-1B) Avail: NTIS HC A11/MF A01 CSCL 01/3

In service experience with helicopter airframe structures, particularly bonded structures and composite materials was surveyed. Laboratory testing was conducted to assess the damage tolerance of several composites in both monolithic and sandwich construction, and to test the effectiveness of simple field type repairs. A method was developed to assess and rank the R&M characteristics of advanced composite structures designs. The method involves a systematic evaluation of the many variables affecting the reliability and maintainability of helicopter airframe structures. Damage potential, damage tolerance, repairability and replaceability are among the key factors evaluated. The product of this analysis is a qualitative rating of structural reliability, hardware reliability and maintainability. Sensitivity studies indicate that advanced composites can be cost effective and that the life cycle costs are dominated by the initial cost of manufacture and by the structural reliability of the design. The R&M and cost characteristics of four advanced composites concepts, representing a cross section of helicopter airframe structures, were analyzed. A.R.H.

N80-32375*# Lockheed-California Co., Burbank.
APPLICATIONS OF ADVANCED ELECTRIC/ELECTRONIC TECHNOLOGY TO CONVENTIONAL AIRCRAFT Final Report, Jul. 1979 - Aug. 1980
R. L. Heimbold Jul. 1980 277 p refs
(Contract NAS9-15863)
(NASA-CR-163576; LR-29520) Avail: NTIS HC A13/MF A01 CSCL 01C

The desirability of seven advanced technologies as applied to three commercial aircraft of 1985 to 1995 was investigated. Digital fly by wire, multiplexing, ring laser gyro, integrated avionics, all electric airplane, electric load management, and fiber optics were considered for 500 passenger, 50 passenger, and 30 passenger aircraft. The major figure of merit used was Net Value of Technology based on procurement and operating cost over the life of the aircraft. An existing computer program, ASSET, was used to resize the aircraft and evalute fuel usage and maintenance costs for each candidate configuration. Conclusions were that, for the 500 passenger aircraft, all candidates had a worthwhile payoff with the all electric airplane having a large payoff. L.F.M.

N80-32376*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME AERODYNAMIC CONSIDERATIONS RELATED TO WIND TUNNEL MODEL SURFACE DEFINITION
Blair B. Gloss Sep. 1980 13 p refs
(NASA-TM-81820) Avail: NTIS HC A02/MF A01 CSCL 01C

The aerodynamic considerations related to model surface definition are examined with particular emphasis in areas of fabrication tolerances, model surface finish, and orifice induced pressure errors. The effect of model surface roughness texture on skin friction is also discussed. It is shown that at a given Reynolds number, any roughness will produce no skin friction penalty. R.C.T.

N80-32377*# Lockheed-Georgia Co., Marietta.
STUDY OF AN ADVANCED TRANSPORT AIRPLANE DESIGN CONCEPT KNOWN AS FLATBED Final Report
R. G. Smethers, E. W. Caldwell, W. E. Warnock, and J. M. Wilson, Jr. Oct. 1980 180 p refs
(Contract NAS1-15867)
(NASA-CR-159337; LGB0ER0085) Avail: NTIS HC A09/MF A01 CSCL 01C

The design concept and configuration of the Flatbed transport aircraft are presented. The Flatbed configuration combines into one frame, the ability to haul cargo, virtually unrestrained by cross sectional dimensions of the fuselage. The feasibility and capability of the Flatbed is discussed in depth. R.C.T.

N80-32378*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ENGINE BLEED AIR REDUCTION IN DC-10
W. H. Newman and M. R. Viele Sep. 1980 75 p refs
(Contract NAS3-21763)
(NASA-CR-159846) Avail: NTIS HC A04/MF A01 CSCL 01C

An 0.8 percent fuel savings was achieved by a reduction in engine bleed air through the use of cabin air recirculation. The recirculation system was evaluated in revenue service on a DC-10. The cabin remained comfortable with reductions in cabin fresh air (engine bleed air) as much as 50 percent. Flight test verified the predicted fuel saving of 0.8 percent. R.C.T.

N80-32379*# Lightning Technologies, Inc., Pittsfield, Mass.
IMPROVED TEST METHODS FOR DETERMINING LIGHTNING-INDUCED VOLTAGES IN AIRCRAFT Final Report
K. E. Crouch and J. A. Plumer Sep. 1980 106 p refs
(Contract NAS4-2613)
(NASA-CR-3329; LT-80-59) Avail: NTIS HC A06/MF A01 CSCL 01C

A lumped parameter transmission line with a surge impedance matching that of the aircraft and its return lines was evaluated as a replacement for earlier current generators. Various test circuit parameters were evaluated using a 1/10 scale relative geometric model. Induced voltage response was evaluated by taking measurements on the NASA-Dryden Digital Fly by Wire F-8 aircraft. Return conductor arrangements as well as other circuit changes were also evaluated, with all induced voltage measurements being made on the same circuit for comparison purposes. The lumped parameter transmission line generates a concave front current wave with the peak di/dt near the peak of the current wave which is more representative of lightning. However, the induced voltage measurements when scaled by appropriate scale factors (peak current or di/dt) resulting from both techniques yield comparable results. L.F.M.

N80-32380# Kuhn (Richard E.), Newport News, Va.
CONCEPTUAL STUDY OF MODIFYING AN EXISTING FIGHTER FOR V/STOL CAPABILITY AND COMBAT MANEUVERING ENHANCEMENT Final Report
Richard E. Kuhn Jul. 1980 59 p refs
(Contract N00167-80-M-0844)
(AD-A087657; DTNSRDC-80/088; DTNSRDC/ASED-AERO-1269) Avail: NTIS HC A04/MF A01 CSCL 01/3

The possibility of modifying an existing fighter aircraft to give it V/STOL capability and of incorporating a V/STOL control system that could also be used in conventional flight to improve the aircraft's combat maneuverability is examined. The study indicates that the F-18 could be given a V/STOL capability using either the lift plus lift-cruise or the vertical attitude take off and landing (VATOL) concept. The lift-cruise plus remote burner concept does not appear to be compatible with the F-18 airframe. The ADEN nozzle concept currently under development, with some modification, could be used on either the lift plus lift-cruise or the VATOL concepts to vector the cruise engine thrust and thereby augment the conventional controls for improved high angle of attack combat maneuverability. GRA

N80-32381# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC PITCH DAMPING OF A DELTA WING AIRCRAFT DETERMINED FROM FLIGHT MEASUREMENTS
R. A. Feik Jul. 1979 30 p refs
(AD-A087771; ARL/AERO-TM-153) Avail: NTIS HC A03/MF A01 CSCL 20/4

A flight investigation aimed mainly at determining the pitch damping of a 60 degree Delta wing aircraft between M 0.7 and M - 1.2 has been undertaken. Flight tests were conducted by ARDU and the measurements obtained have been successfully

analysed at ARL using a modified Newton-Raphson parameter estimation procedure. The results for pitch damping as well as other longitudinal aerodynamic derivatives have been compared with wind tunnel and/or theoretical estimates. Further information has also been gained relating to the necessary conditions for successful extraction of parameters from flight data. The parameter estimation procedure has proved to be an effective analysis method even when only a modest amount of flight data, obtained using a relatively simple instrumentation package, has been available. GRA

N80-32382# Naval Ship Research and Development Center, Bethesda, Md.
DEVELOPMENT OF HIGH LIFT DEVICES FOR APPLICATION TO ADVANCED NAVY AIRCRAFT Final Report
James H. Nichols, Jr. Apr. 1980 47 p ref Presented at the Workshop on V/STOL Aerodyn., Monterey, Calif., 16-18 May 1979
(WF41421091)
(AD-A084226; DTNSRDC-80/058; DTNSRDC/AERO-1266) Avail: NTIS HC A03/MF A01 CSCL 01/3

A number of methods for generating high lift to provide a short takeoff and landing (STOL) capability for advanced Navy aircraft are evaluated with emphasis on low aspect ratio wings. Upper surface blowing, circulation control wing, and wing tip sails are given the most attention. Experimental data were obtained in the wind tunnels on these concepts as specifically applied to wings of aspect ratios 3 to 5. Flight demonstrations of a circulation control wing application to the A-6 aircraft showed the ability to more than double the lifting capability which resulted in landing speed reductions of more than 30 percent, landing ground roll reductions of more than 50 percent, and takeoff distance reductions of at least 25 percent. The experimental high lift system data was applied to a conceptual STOL baseline aircraft in order to estimate the impact on mission performance and identify their various merits as applicable to the particular restrictions of small ship operations. T.M.

N80-32383# Rockwell International Corp., Thousand Oaks, Calif.
COMPUTATIONAL AND SIMPLIFIED ANALYTICAL TREATMENT OF TRANSONIC WING-FUSELAGE-PYLON-STORE INTERACTIONS Final Technical Report, 1 Jul. 1978 - 31 Dec. 1979
Vijaya Shankar and Norman D. Malmuth 25 Apr. 1980 17 p refs Presented at the AIAA 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980
(Contract N00014-78-C-0477; NR Proj. 212-257)
(AD-A085619; ONR-CR-212-257-IF; SC5172.10TR) Avail: NTIS HC A02/MF A01 CSCL 01/3

Transonic modified small disturbance theory was employed to numerically model the flow field around wing-fuselage-pylon-store configurations. A fine grid region enclosing the wing-pylon-store was embedded within a global crude grid and a successive crude-fine relaxation was performed. With a simple image point concept, the store and the pylon were introduced into an existing wing fuselage program thus avoiding excessive additional computer memory requirements. Comparison on results with experiments for the F-5 wing with a pylon-store arrangement is presented. A study of the roles of pylon height, store diameter, pylon span mount location, angle of attack and Mach number relative to the achievement of optimum L/D from beneficial nonlinear interference is presented. A simplified analytical approach to compute the loading on the store using an immersion theory is indicated and validated against experiments. T.M.

N80-32384# Boeing Vertol Co., Philadelphia, Pa.
DESIGN AND ANALYSIS OF CH-47 EXTERNAL CARGO HANDLING SYSTEM (SNUBBED LOAD) Final Report, Sep. 1977 - Oct. 1979
Theodore S. Garnett, Jr., Richard F. Campbell, and David J. Hodder Oct. 1979 445 p refs
(Contract DAAJ02-77-C-0069)
(AD-A088057; D210-11555-1) Avail: NTIS HC A19/MF A01 CSCL 01/3

Development of a preliminary design concept to snub containerized external cargo loads to the CH-47 aircraft, for improved terrain and Night/IMC flight capability, has been completed. Results are suitable for detail design implementations leading to prototype demonstration of the system in the future. The External Cargo Handling System (ECHS) snubs loads (of up to 25,000 lbs. weight) against the helicopter landing gear, using a self hoisting adapter framework powered by 6 horsepower tandem electric hoists installed of nonlinear vibration isolation mounts to interface the load with the aircraft. The ECHS snubbing adapter uses guide arms for load acquisition assistance, and twistlocks to lock the load to the adapter. No structural modification to the CH-47 is required. Compared to carrying cargo on conventional external sling suspension with a CLAH adapter, load snubbing provides a substantial performance benefit for terrain flight missions; and at the same time improves both masking and maneuverability along with capability for flight at night, or in IMC condition. GRA

N80-32385# Solar Turbines International, San Diego, Calif.
MANUFACTURING PROCESS DEVELOPMENT FOR DUST AND RAIN EROSION RESISTANT COATED METALLIC CLADS FOR HELICOPTER ROTORS Final Report, 5 Apr. 1976 - 30 Jul. 1980
David P. Huey and Alvin R. Stetson Jun. 1980 184 p refs
(Contract DAAG46-76-C-0033)
(AD-A088440; SR80-R-4511-37) Avail: NTIS HC A09/MF A01 CSCL 13/8

Manufacturing processes for creating erosion resistant coatings on metallic rotor blade leading edges were optimized as a follow on to a coating development program sponsored by AMMRC (Contract DAAG74-C-0054). Solide coated, titanium rotor nose caps were produced in sections up to 30 inches long. Commercially pure (A75) and alloyed (Ti-6Al-4V) titanium was used. Newly developed graphite coating mandrels made possible simultaneous coating and creep forming of titanium sheet material to accurate airfoil contours. Sand and rain erosion tests were performed along with tensile, impact, salt spray and adhesive bonding tests. Costs per part for production quantities were estimated. Solide coated test specimens of titanium and SAE 430 stainless steel were provided to three major helicopter manufacturers for test and evaluation: Hughes, Sikorsky and Bell. Their conclusions were that Solide coatings are excellent in rain erosion resistance and low angle sand erosion resistance but do not meet minimum survival requirements when subjected to sand erosion by large particles (greater than 100 micrometer) impinging at high angles (greater than 45 degrees). GRA

N80-32386# Sikorsky Aircraft, Stratford, Conn. Aircraft Div.
HELICOPTER DYNAMIC PERFORMANCE PROGRAM. VOLUME 1: ENGINEER'S MANUAL Final Report, Nov. 1978 - Nov. 1978
Robert E. Studwell Jul. 1980 136 p refs
(Contract DAAJ02-76-C-0066; DA Proj. 1F2-62209-AH-76)
(AD-A088474; SER-510011-Vol-1; USARTL-TR-79-27A-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/3

A computer program for evaluating helicopter performance in accelerated flight has been developed. The program was designed to permit analysis of any definable single rotor helicopter. Provisions for partial or total power loss at any point along the flight path are included. To accommodate emergency conditions provisions are made for evaluation of auxiliary power devices, tip rockets, JATO, RATO, fly wheels, drag brakes, and dropping of external loads. Optimization routines for establishing height velocity envelopes are also included. The program is linked with a plot package which provides 40 prime output variables to be plotted. A perspective view of the flight path and plots of height velocity diagrams are also available. This volume covers the engineering aspects of the program. Volume 2 presents the User's Manual. GRA

N80-32387# Sikorsky Aircraft, Stratford, Conn.
HELICOPTER DYNAMIC PERFORMANCE PROGRAM. VOLUME 2: USER'S MANUAL Final Report
R. E. Studwell Jul. 1980 101 p
(Contract DAAJ02-76-C-0066; DA Proj. 1F2-62209-AH-76)
(AD-A088318; USARTL-TR-79-27-B-Vol-2; SER-510011-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

The program provides a means of rapidly estimating rotorcraft takeoff and landing capabilities from or to any given heliport size or location. Proper application of the instructions outlined

herein for computing opertional capabilities and flight procedures can minimize the risk and cost of testing rotorcraft capabilities in the takeoff, landing and emergency of flight. The program has been written in FORTRAN IV and designed primarily for interactive operation on the IBM 360/65 computer system, in conjunction with a PDP-11 and DEC-GT-40 scope and a Houston bed type plotter. Interfacing with a Tektronix storage tube Model 4010, 4012, or 4014, the Houston plot bed and the IBM 360/65 is also available. Options for batch processing with and without Houston plots has been provided. With minor modifications the program can also be interfaced with a CDC or UNIVAC 1110 in lieu of the IBM 360/65. Program modifications required for CDC 6600 compatibility are covered in Section 9 of this report. GRA

N80-32388# Monsanto Research Corp., Dayton, Ohio.
INTEGRAL AIRCRAFT FUEL TANK LEAK CLASSIFICATION Interim Technical Report, 1 Sep. 1978 - 15 Apr. 1979
Leo Parts, Thomas J. Bucher, Benito P. Botteri (AFAPL, Wright-Patterson AFB, Ohio), and Robert E. Cretcher (AFAPL, Wright-Patterson AFB, Ohio) Jan. 1980 193 p refs
(Contract F33615-78-C-2023; AF Proj. 3048)
(AD-A088168; MRC-DA-894; AFAPL-TR-79-2992) Avail: NTIS HC A09/MF A01 CSCL 01/2

A parametric study has been conducted to investigate external leakage from aircraft integral fuel tanks. The effects of the following parameters on the rate of surface dispersion of fuels were examined: fuel type, leakage rate, surface material, fuel and surface temperature, air flow rate over the test surface, and surface angle of inclination. The dispersing fuel films were found to be very thin (0.05 mm/0.002 in.); i.e., limited liquid volume flow results in extensive surface coverage. Fuels of low volatility such as JP-5 and JP-8 dispersed at a faster rate over the surface and exhibited a greater propensity for dripping than those of high volatility (AvGas and JP-4). Low temperatures, inclined surfaces, and polyurethane latex surface coating enhanced fuel dripping from the test surface. Fuel flow rates required to support sustained burning at the leakage site were investigated with JP-4, JP-5, JP-8, JP-4/JP-8 mixtures, and AvGas. The measurements were conducted at temperatures ranging from 3.3 C to 98 C (38 F to 209 F). The vapor pressure of the fuel at the test temperature has a very pronounced effect on the propensity of the leaking fuel to sustain burning. The minimum volume flow rates required for sustained burning ranged from 0.2 ml/min. (AvGas at 23 C (73 F)) to 9 ml/min. (JP-5 at 98 C (208 F)). GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-32389*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
USE OF NOSE CAP AND FUSELAGE PRESSURE ORIFICES FOR DETERMINATION OF AIR DATA FOR SPACE SHUTTLE ORBITER BELOW SUPERSONIC SPEEDS
Terry J. Larson and Paul M. Siemers, III (NASA. Langley Research Center) Sep. 1980 128 p refs
(NASA-TP-1643; H-1096) Avail: NTIS HC A07/MF A01 CSCL 01D

Wind tunnel pressure measurements were acquired from orifices on a 0.1 scale forebody model of the space shuttle orbiter that were arranged in a preliminary configuration of the shuttle entry air data system (SEADS). Pressures from those and auxiliary orifices were evaluated for their ability to provide air data at subsonic and transonic speeds. The orifices were on the vehicle's nose cap and on the sides of the forebody forward of the cabin. The investigation covered a Mach number range of 0.25 to 1.40 and an angle of attack range from 4 deg. to 18 deg. An air data system consisting of nose cap and forebody fuselage orifices constitutes a complete and accurate air data system at subsonic and transonic speeds. For Mach numbers less than 0.80 orifices confined to the nose cap can be used as a complete and accurate air data system. Air data systems that use only flush pressure orifices can be used to determine basic air data on other aircraft at subsonic and transonic speeds. T.M.

N80-32390# Rockwell International Corp., Columbus, Ohio. Autonetics Missile Systems Div.
OH-58C HELICOPTER MAST MOUNTED SIGHT/DESIGNATOR SAFETY STATEMENT
21 Feb. 1980 51 p refs
(Contract DAAK10-77-C-0212)
(AD-A087673; CB0-1337/034C) Avail: NTIS HC A04/MF A01 CSCL 19/5

The Safety Statement was prepared by the Autonetics Columbia, OH Missile Systems Division of Rockwell International under Contract DAAK10-77-C-0212 for the design and fabrication of a mast mounted sight, with integrated laser designator, that is mounted above the rotor mast of an OH-58C helicopter. It was found, based upon design data, operating and maintenance procedures, and experience gained in the laboratory, that the GFP laser within the mast mounted sight can be used and maintained with hazards controlled within acceptable limits.GRA

N80-32391# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Manpower and Educational Systems Technical Area.
HELICOPTER ELECTRO-OPTICAL SYSTEM DISPLAY REQUIREMENTS. 3: THE EFFECTS OF CRT DISPLAY SIZE AND LUMINANCE ON DARK ADAPTATION OF HELICOPTER PILOTS
Richard M. Johnson, Aaron Hyman, and Paul A. Gade Mar. 1980 18 p refs
(DA Proj. 2Q1-62722-A-765)
(AD-A088527; ARI-TR-443) Avail: NTIS HC A02/MF A01 CSCL 05/8

Previous research has indicated that pilots may be able to successfully use a television display of low luminance level as an aid to nighttime nap-of-the-Earth helicopter flight. This experiment was conducted to assess the effects of display luminance level and display size on pilots' visual dark adaptation. Brightness matches made by 12 Army helicopter pilots were used to determine the magnitude of the dark-adaptation loss that resulted from viewing a 13 cm and a 26 cm CRT display at relatively bright and dim luminance levels. In the procedure used, one eye was light adapted to the CRT panel display while the other eye remained dark adapted. Then, while the pilots viewed a simulated windscreen display, the luminance setting for the dark-adapted eye was adjusted independently until the display appeared equally bright to both eyes. Windscreen display luminance for the previously light-adapted eye remained fixed at a highlight brightness of 0.01 footlambert (equivalent to full Moon illumination). The larger display was judged to produce the greater dark-adaptation loss, even though the larger display could be successfully used at a lower luminance level. This result might have been due the the greater involvement of the peripheral rod retinal receptor cells when pilots made judgments following exposure to the larger light-adapting display. In such a case, selective attenuation of the blue end of the spectral energy output from the CRT phosphor could reduce the magnitude within 1 second after light adaptation to a dim 26 cm television display showed a 67% loss in the apparent brightness of the windscreen display. This is equivalent to flying under one-third full moon conditions. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-32392* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRCRAFT ENGINE NOZZLE Patent
Norman E. Sorensen and Eldon A. Latham, inventors (to NASA) Issued 29 Jul. 1980 7 p Filed 23 Mar. 1979 Supersedes N79-23971 (17 - 15, p 1934)
(NASA-Case-ARC-10977-1; US-Patent-4,214,703; US-Patent-Appl-SN-023436; US-Patent-Class-239-127.3; US-Patent-Class-60-264; US-Patent-Class-239-265.33) Avail: US Patent and Trademark Office CSCL 21E

A variable area exit nozzle arrangement for an aircraft engine was a substantially reduced length and weight which comprises a number of longitudinally movable radial vanes and a number of fixed radial vanes. The movable radial vanes are alternately disposed with respect to the fixed radial vanes. A means is provided for displacing the movable vanes along the longitudinal axis of the engine relative to the fixed radial vanes which extend across the main exhaust flow of the engine.
Official Gazette of the U.S. Patent and Trademark Office.

N80-32393*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
MULTIPLE PURE TONE ELIMINATION STRUT ASSEMBLY Patent Application
Frank W. Burcham, Jr., inventor (to NASA) Filed 11 Sep. 1980 9 p
(NASA-Case-FRC-11062-1; US-Patent-Appl-SN-185869) Avail: NTIS HC A02/MF A01 CSCL 21E

An acoustic noise elimination assembly is described which has a capability for disrupting the continuity of fields of sound pressures forwardly projected from fans or rotors of a type commonly found in the fan or compressor first stage for airbreathing engines when operating at top speeds in the supersonic range. The assembly includes a tubular cowl defining a duct for delivering an airstream axially into the intake for a jet engine and a sound barrier defined by a plurality of intersecting flat plates or struts, having a line of intersection coincident with a longitudinal axis of the tubular cowl which serves to disrupt the continuity of rotating fields of multiple pure tonal components of noise. NASA

N80-32394*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE DETERIORATION OF COMMERCIAL HIGH-BYPASS RATIO TURBOFAN ENGINES
Charles M. Mehalic and Joseph A. Ziemianski 1980 30 p refs Presented at SAE Aerospace Congr., Los Angeles, 13-16 Oct. 1980 and at the 56th AGARD Propulsion and Energetics Symp. on Turbine Engine Testing, Turin, 29 Sep. - 3 Oct. 1980 Revised
(NASA-TM-81552-Rev; E-511-Rev) Avail: NTIS HC A03/MF A01 CSCL 21E

The results of engine performance deterioration investigations based on historical data, special engine tests, and specific tests to define the influence of flight loads and component clearances on performance are presented. The results of analyses of several damage mechanisms that contribute to performance deterioration such as blade tip rubs, airfoil surface roughness and erosion, and thermal distortion are also included. The significance of these damage mechanisms on component and overall engine performance is discussed. E.D.K.

N80-32395*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ENERGY EFFICIENT ENGINE PROJECT Status Report
Lawrence E. Macioce, John W. Schaefer, and Neal T. Saunders 1980 42 p refs Presented at the Aerospace Congr., Los Angeles, 13-16 Oct. 1980
(NASA-TM-81566; E-531) Avail: NTIS HC A03/MF A01 CSCL 21E

The Energy Efficient Engine Project is directed at providing, by 1984, the advanced technologies which could be used for a generation of fuel conservative turbofan engines. The project is conducted through contracts with the General Electric Company and Pratt and Whitney Aircraft. The scope of the entire project and the current status of these efforts are summarized. A description of the preliminary designs of the fully developed engines is included and the potential benefits of these advanced engines, as well as highlights of some of the component technology efforts conducted to date, are discussed. E.D.K.

N80-32396*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-PRESSURE PERFORMANCE OF ANNULAR, HIGH-PRESSURE (40 ATM) HIGH-TEMPERATURE (2480 K) COMBUSTION SYSTEM
Jerrold D. Wear Washington Sep. 1980 20 p refs
(NASA-TP-1713; E-372) Avail: NTIS HC A02/MF A01 CSCL 21E

Experimental tests were conducted to develop a combustion system for a 40 atmosphere pressure, 2480 K exhaust gas temperature, turbine cooling facility. The tests were conducted in an existing facility with a maximum pressure capability of 10 atmospheres and where inlet air temperatures as high as 894 K could be attained. Exhaust gas temperatures were as high as 2365 K. Combustion efficiences were about 100 percent over a fuel air ratio range of 0.016 to 0.056. Combustion efficiency decreased at leaner and richer ratios when the inlet air temperature was 589 K. Data are presented that show the effect of fuel air ratio and inlet air temperature on liner metal temperature. Isothermal system pressure loss as a function of diffuser inlet Mach number is also presented. Data included exhaust gas pattern factors; unburned hydrocarbon, carbon monoxide, and oxides of nitrogen emission index values; and smoke numbers. Author

N80-32397*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PRELIMINARY ASSESSMENT OF THE IMPACT OF 2-D EXHAUST-NOZZLE GEOMETRY ON THE CRUISE RANGE OF A HYPERSONIC AIRCRAFT WITH TOP-MOUNTED RAMJET PROPULSION
Walter A. Vahl and John P. Weidner Washington Sep. 1980 60 p refs
(NASA-TM-81841; L-13518) Avail: NTIS HC A04/MF A01 CSCL 21E

A theoretical study of full length and shortened, two dimensional, isentropic, exhaust nozzles integrated with top mounted ramjet propulsion nacelles were conducted. Both symmetric and asymmetric contoured nozzles with a range of angular orientations were considered. Performance comparisons to determine optimum installations for a representative hypersonic vehicle at Mach 5 cruise conditions are presented on the basis of cruise range, propulsive specific impulse, inlet area requirements, and overall lift drag ratio. The effect of approximating the nozzle internal contours with planar surfaces and the determination of viscous and frozen flow effects are also presented. T.M.

N80-32398# Systems Research Labs., Inc., Newport News, Va. RASA Div.
INVESTIGATION OF PERFORMANCE, NOISE, AND DETECTABILITY CHARACTERISTICS OF REMOTELY PILOTED VEHICLE (RPV) PROPELLERS Final Report
D. S. Janaki Ram Jun. 1980 168 p refs
(Contract DAAJ02-77-C-0029)
(AD-A088325; RASA/SRL-14-79-05; USAAVRADCOM-TR-80-D-7) Avail: NTIS HC A08/MF A01 CSCL 01/3

Several small scale propeller configurations applicable to a conceptual Remotely Piloted Vehicle (RPV) aircraft were designed, fabricated, and tested to determine their performance, acoustic, and detectability characteristics. The tests were conducted in static and simulated forward flight conditions in a wind tunnel. Propellers tested included tractor, pusher, and ducted configurations. The acoustic data obtained were used to determine the slant range and altitude of no detection of each propeller configuration. The data were analyzed to determine the effects of blade number, blade design (activity factor and twist), diameter, tip speed, thrust, and forward velocity on the acoustic and detectability characteristics of the propeller configurations tested. The performance data did not show any conclusive trends except that the ducted and pusher propeller configurations tested were less efficient than their open and tractor counterparts respectively. GRA

N80-32399# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

LOW COST PROCESS FOR MANUFACTURING OF OXIDE DISPERSION STRENGTHENED (ODS) TURBINE NOZZLE COMPONENTS Final Report, 30 Jun. 1976 - 31 Dec. 1979
J. A. Stahl, R. J. Perkins, and P. G. Bailey Dec. 1979 143 p refs
(Contract F33615-76-C-5235; AF Proj. 8556)
(AD-A088019; AFML-TR-79-4163) Avail: NTIS HC A07/MF A01 CSCL 21/5

This final technical report describes a program for producing low cost processes for the manufacture of Oxide Dispersion Strengthened (ODS) turbine nozzle components. The processes established in this program will demonstrate that high pressure turbine vanes, low pressure turbine vanes and high pressure turbine bands can be manufactured from near net shape components via directional forging and forge bending. GRA

N80-32400# McDonnell-Douglas Research Labs., St. Louis, Mo.
UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Miklos Sajben, Thomas J. Bogar, and Joseph C. Kroutil May 1980 30 p refs
(Contract F49620-77-C-0082; AF Proj. 2307)
(AD-A088231; AFOSR-80-0628TR) Avail: NTIS HC A03/MF A01 CSCL 21/5

Extensive measurements of shock position and pressure distributions (wall static, core flow static, and core flow total) were made, complemented by spark schlieren and high speed schlieren photographic information. Measurements were made at shock Mach numbers up to 1.35, with and without excitation. The excitation amplitudes were low, with frequencies from 0 to 330 Hz. Unexcited flows displayed two dominant natural frequencies for attached flows (shock Mach numbers below 1.27) and one dominant peak for separated flows (shock Mach numbers above 1.28). The dominant frequencies depend strongly on shock strength. Diffuser response to excitation appears to follow patterns expected on the basis of low amplitude (acoustic) wave propagation concepts, provided that the stream wise variation of the flow speed is considered and realistic boundary conditions are applied at the ends of the channel. The study strongly suggests that the effective acoustic impedance associated with the shock/boundary layer interaction zone is an important determinant of diffuser response to small amplitude external perturbations. GRA

N80-32401# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
PROJECT SQUID Final Technical Report, Oct. 1967 - Dec. 1979
R. F. Hoglund, R. Goulard, and S. N. B. Murthy Feb. 1980 242 p
(Contracts N00014-75-C-1143; N00014-67-A-0226; NR Proj. 098-038; Proj. SQUID)
(AD-A088006; SQUID-PU-R2-80) Avail: NTIS HC A11/MF A01 CSCL 21/5

The Final Technical Report provides a summary report of the activities under Project SQUID carried out under Contracts N00014-67-0226, N00014-67-A-0226 and N00014-75-C-1143 during the period Oct. 1967-Dec. 1979 with the Office of Naval Research. Projects carried out under subcontract to Purdue University as well as Workshops and Colloquia organized under the auspices of Project SQUID are discussed. Project SQUID is a continuing program devoted to fundamental research of long range relevance to the technology of jet propulsion. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-32402*# Oklahoma State Univ., Stillwater.
HANDLING QUALITIES OF LARGE FLEXIBLE AIRCRAFT Ph.D. Thesis
Supat Poopaka Dec. 1980 72 p
(Grant NsG-4018)
(NASA-CR-163583) Avail: NTIS HC A04/MF A01 CSCL 01C

The effects on handling qualities of elastic modes interaction with the rigid body dynamics of a large flexible aircraft are studied by a mathematical computer simulation. An analytical method to predict the pilot ratings when there is a severe modes interactions is developed. This is done by extending the optimal control model of the human pilot response to include the mode decomposition mechanism into the model. The handling qualities are determined for a longitudinal tracking task using a large flexible aircraft with parametric variations in the undamped natural frequencies of the two lowest frequency, symmetric elastic modes made to induce varying amounts of mode interaction. R.C.T.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see *also 14 Ground Support Systems and Facilities (Space).*

N80-32403*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODELING AND CONTROL OF TRANSONIC CRYOGENIC WIND TUNNELS Final Summary Report, period ending Oct. 1980
S. Balakrishna and A. Tennille, ed. Oct. 1980 53 p refs
(Grant NsG-1503)
(NASA-CR-163588) Avail: NTIS HC A04/MF A01 CSCL 14B

The problem of automatic control of fan driven closed circuit, transonic, cryogenic tunnels, which use gaseous nitrogen as the test medium and sprayed liquid nitrogen as the coolant was investigated. Operation of the tunnel gas of a wind tunnel at cryogenic temperatures yielded considerable enhancement of flow Reynolds number. This property was successfully exploited in realizing free flight equivalent flow Reynolds numbers on relatively small models. This quantum improvement in Reynolds number capability was demonstrated by the successful operation of the 0.3 meter Transonic Cryogenic Tunnel (0.3 m TCT). The initial operation of the 0.3 m TCT was by manual manipulation of the tunnel control inputs: liquid nitrogen flow into the tunnel by a valve, gaseous nitrogen flow out of the tunnel by a valve, and the fan speed. The operating experience indicated a highly coupled process which tended to creep away from equilibrium. This pointed to a need for automatic control of the cryogenic tunnel. T.M.

N80-32404*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
SELECTED DATA FROM A TRANSONIC FLEXIBLE WALLED TEST SECTION Semiannual Progress Report
S. W. D. Wolf Sep. 1980 108 p refs
(Grant NsG-7172)
(NASA-CR-159360) Avail: NTIS HC A06/MF A01 CSCL 14B

Twenty four test runs of the Transonic Self-Streamlining Wind Tunnel were performed with the flexible walls 'streamlined' around a two dimensional section of four inch chord, over the Mach number range 0.3 to 0.89. Relevant wall and model data for the streamlined cases are presented. L.F.M.

N80-32405*# Boeing Aerospace Co., Seattle, Wash.
LASER ANGLE MEASUREMENT SYSTEM Final Report
C. R. Pond, P. D. Texeira, and R. E. Wilbert Oct. 1980 51 p
(Contract NAS1-15410)
(NASA-CR-159306; D180-25234-1) Avail: NTIS HC A04/MF A01 CSCL 14B

The design and fabrication of a laser angle measurement system is described. The instrument is a fringe counting interferometer that monitors the pitch attitude of a model in a wind tunnel. A laser source and detector are mounted above the mode. Interference fringes are generated by a small passive element on the model. The fringe count is accumulated and

displayed by a processor in the wind tunnel control room. Optical and electrical schematics, system maintenance and operation procedures are included, and the results of a demonstration test are given. R.C.T.

N80-32406# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DESIGN CONCEPT FOR FUEL FIRE FACILITY SCALE-DOWN Final Report
John R. Piergallini Aug. 1979 58 p refs
(WF51523000)
(AD-A084624; NADC-79227-60) Avail: NTIS HC A04/MF A01 CSCL 14/2

An all-weather, self-sustaining, indoor fuel-fire facility for the generation of data for the evaluation of burn-protective capacity of personal gear for naval aircrewmen and flight deck personnel in full-scale fuel fire exposures was developed. A scaled-down indoor version of the existing fuel-fire facility provided realistic data for protective-capacity analysis. An automated enclosed facility allows experiments to be conducted efficiently indoors in a closely controlled environment with minimal risk to personnel and surrounding and with more timely and consistent results in the analysis of data for burn protection of naval aircrewmen. T.M.

N80-32407# Southwest Research Inst., San Antonio, Tex. Engineering Sciences Div.
NEW CONCEPT STUDY FOR REPAIR OF BOMB-DAMAGED RUNWAYS. VOLUME 1: CONCEPT IDENTIFICATION Final Report, 1 May 1977 - 24 Jul. 1978
E. Jack Baker, Jr. and Ernest P. Bergmann Sep. 1979 186 p refs
(Contract F08635-77-C-0154; AF Proj. 2104)
(AD-A088188; Rept-02-4891-Vol-1; AFESC/ESL-TR-79-27-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 01/5

An in depth review of bomb crater repair processes and material resulted in the identification of twelve concepts. Each concept is a general solution to the problem of crater repair which is amenable to implementation using numerous combinations of fill and cap materials. In addition to the study and description of repair processes, an in depth review of alternate runway strategies is presented. GRA

N80-32408# Sperry Rand Corp., Huntsville, Ala. Support Services.
AUTOMATIC TEST EQUIPMENT Final Technical Report
28 Feb. 1980 150 p refs
(Contract DAAK40-79-D-0020; DA Proj. 1L1-62303-A-214)
(AD-A088177; AD-E950018; SP-212-1055; DRSMI-RL-CR-80-3) Avail: NTIS HC A07/MF A01 CSCL 14/2

This report presents an overview of recent activities within Industry and the Department of Defense on Automatic Test Equipment (ATE). A review of ad hoc projects both within the services and jointly with industry is presented beginning with the Electronic Test Equipment Task Force established in 1974. A brief description of the major ATE systems in use by the Navy and Air Force together with a more detailed description of existing and planned Army ATE is presented. The report concludes with the need to emphasize Built-In Test Equipment in future Army missile systems. GRA

N80-32409# Federal Lab. Consortium, Washington, D. C.
FEDERAL LABORATORY CONSORTIUM RESOURCE DIRECTORY
Nov. 1979 159 p Prepared in cooperation with Naval Weapons Center, China Lake, Calif.
(Grant NSF ISP-78-22221)
(PB80-199078; NSF/RA-790268) Avail: NTIS HC A08/MF A01 CSCL 14B

This directory of the resource capability within Federal laboratories, contains information to bridge the communications gap between the Federal Laboratory Consortium and potential users in the public and private sectors. A map pinpointing the locations of the Consortium's member laboratories and an alphabetical list of the Consortium's laboratories, detailing their areas of application and activity is contained. More specific sub-areas are given under each general listing, and each sub-area includes a list of laboratories in that particular area of expertise. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N80-32410* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS. A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 3
Jul. 1980 85 p
(NASA-SP-7046(03)) Avail: NTIS HC $8.00 CSCL 22A

A bibliography containing 217 abstracts addressing the technology for large space systems is presented. State of the art and advanced concepts concerning interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments are represented. M.G.

N80-32411*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
POTENTIAL PROBLEMS RELATIVE TO TDRS/IUS TILT TABLE ELEVATION WITH FAILED VRCS
Jerome Bell Sep. 1980 29 p
(NASA-TM-82201; JSC-16870; IN-80-FM-50) Avail: NTIS HC A03/MF A01 CSCL 22A

Operational concerns and preliminary solution alternatives related to elevating the inertial upper stage/tracking and data relay satellite (IUS/TDRS) with a failed orbiter vernier reaction control system (VRCS) are presented. Problems arise from the combination of TDRS thermal constraints and tilt table constraints (the primary reaction control system (PRCS) cannot be used to hold attitude while the tilt table is being elevated), and the problems are compounded by the minimum PRCS attitude deadband. The potential solution options are affected by the launch window, flight profile, crew procedures, vehicle capability and constraints, and flight rules. T.M.

N80-32412*# General Dynamics/Convair, San Diego, Calif.
COMPARATIVE THERMAL ANALYSIS OF ALTERNATE CRYOGENIC FLUID MANAGEMENT EXPERIMENT (CFME) CONFIGURATIONS
F. Merino and R. F. ONeill Jul. 1980 66 p refs
(Contract NAS3-21935)
(NASA-CR-165151; GDC-CRAD-80-014) Avail: NTIS HC A04/MF A01 CSCL 22A

The Cryogenic Fluid Management Experiment (CFME) was analyzed to assess the feasibility and advisability of deleting the vapor cooled shield (VCS) from the baseline CFME insulation and pressure control system. Two alternate concepts of CFME insulation and pressure control, neither of which incorporated the VCS, were investigated. The first concept employed a thermodynamic vent system (TVS) to throttle the flow through an internal wall mounted heat exchanger (HX) within the pressure vessel to decrease boiloff and pressure rise rate, while the second concept utilized a TVS without an internal heat exchanger. Only the first concept was viable. Its performance was assessed for a seven day mission and found to be satisfactory. It was also concluded that VCS development costs would be greater than for an internal HX installation. Based upon the above comparisons, the HX was recommended as a replacement for the VCS. A.R.H.

N80-32413*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
A STUDY ON VARIOUS METHODS OF SUPPLYING PROPELLANT TO AN ORBIT INSERTION ROCKET ENGINE Final Technical Report
John E. Boretz, Sam Huniu, Matt Thompson, Mike Pagani, Bob Paulsen, Joe Lewis, and Don Paul 9 May 1980 170 p refs
(Contracts NAS7-100; JPL-955656)
(TRW/DSSG-36358.001; NASA-CR-163587; JPL-9950-415) Avail: NTIS HC A08/MF A01 CSCL 22A

Various types of pumps and pump drives were evaluated to

determine the lightest weight system for suppplying propellants to a planetary orbit insertion rocket engine. From these analyses four candidate propellant feed systems were identified. Systems Nos. 1 and 2 were both battery powered (lithium-thionyl-chloride or silver-zinc) motor driven pumps. System 3 was a monopropellant gas generator powered turbopump. System 4 was a bipropellant gas generator powered turbopump. Parameters considered were pump breake horsepower, weight, reliability, transient response and system stability. Figures of merit were established and the ranking of the candidate systems was determined. Conceptual designs were prepared for typical motor driven pumps and turbopump configurations for a 1000 lbf thrust rocket engine.
T.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-32414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
UAH/NASA WORKSHOP ON SPACE SCIENCE PLATFORM
S. T. Wu, ed. (Alabama Univ., Huntsville) and Samuel Morgan, ed. Dec. 1978 205 p refs Workshop held at Joe Wheeler State Park Resort, Ala., 21-25 Aug. 1978
(NASA-TM-82204) Avail: NTIS HC A10/MF A01 CSCL 22B

The scientific user requirements for a space science platform were defined. The potential user benefits, technological implications and cost of space platforms were examined. Cost effectiveness of the platforms' capabilities were also examined.
T.M.

N80-32415# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM HANDBOOK. VOLUME 3: PROGRAM SUPPORT PLAN AND OPERATIONS DIRECTIVE Final Report
Nov. 1979 218 p
(AD-A088222; DG-501-79-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 14/2

This volume of the Universal Documentation System handbook presents procedures to be followed in preparing the program support plan and operations directive documents to be used by support agencies. Responsibilities and security aspects are considered in the support requirements.
GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-32416*# Vought Corp., Dallas, Tex.
ENVIRONMENTAL PROTECTION REQUIREMENTS FOR SCOUT/SHUTTLE AUXILIARY STAGES Final Report
G. L. Qualls, S. S. Kress, W. W. Storey, and P. N. Ransdell Sep. 1980 66 p refs
(Contract NAS1-12500)
(NASA-CR-3328) Avail: NTIS HC A04/MF A01 CSCL 13B

The requirements for enabling the Scout upper stages to endure the expected temperature, mechanical shock, acoustical and mechanical vibration environments during a specified shuttle mission were determined. The study consisted of: determining a shuttle mission trajectory for a 545 kilogram (1200 pound) Scout payload; compilation of shuttle environmental conditions; determining of Scout upper stages environments in shuttle missions; compilation of Scout upper stages environmental qualification criteria and comparison to shuttle mission expected environments; and recommendations for enabling Scout upper stages to endure the exptected shuttle mission environments.
R.K.G.

N80-32417*# Martin Marietta Corp., Denver, Colo.
TITAN PROBE TECHNOLOGY ASSESSMENT AND TECHNOLOGY DEVELOPMENT PLAN STUDY Final Report
Angelo J. Castro Jul. 1980 191 p refs
(Contract NAS2-10380)
(NASA-CR-152381; TPT-MA-02-3) Avail: NTIS HC A09/MF A01 CSCL 22B

The need for technology advances to accomplish the Titan probe mission was determined by defining mission conditions and requirements and evaluating the technology impact on the baseline probe configuration. Mission characteristics found to be technology drivers include (1) ten years dormant life in space vacuum; (2) unknown surface conditions, various sample materials, and a surface temperature; and (3) mission constraints of the Saturn Orbiter Dual Probe mission regarding weight allocation. The following areas were identified for further development: surface sample acquisition system; battery powered system; nonmetallic materials; magnetic bubble memory devices, and the landing system. Preentry science, reliability, and weight reduction and redundancy must also be considered.
A.R.H.

N80-32418*# California Univ., Berkeley. Space Sciences Lab.
FILTER DEVELOPMENT FOR THE EXTREME ULTRAVIOLET EXPLORER Final Report, 10 Jul. 1977 - 30 Jun. 1980
Randy Kimble and Patrick Jelinsky 30 Jun. 1980 22 p
(Contract NAS5-24189)
(NASA-CR-160039) Avail: NTIS HC A02/MF A01 CSCL 22B

Thin film filters with extreme ultraviolet bandpasses unattainable with previously available filter materials were developed. Titanium and antimony were identified as the most promising materials for providing the scientifically important 350-500 A bandpass heretofore unattainable with thin film filters. Titanium foils and titanium-antimony sandwich foils of the required uniformity and durability were fabricated. Transmission measurements and optimization studies indicate that the titanium-antimony combination provides an ideal bandpass for scientifically valuable, high-sensitivity observations with EUVE. Environmental testing of the mechanical strength, moisture sensitivity and aging characteristics of the newly developed filter materials demonstrate flightworthy performance.
S.F.

N80-32419# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council of Scientific and Technical Research.
APT 80-1 TECHNICAL NOTES [NOTA TECNICA APT 80-1]
Marlene Elias Aug. 1980 9 p In POLISH
(INPE-1845-NTE/162) Avail: NTIS HC A02/MF A01

Technical data concerning TIROS-N and NOAA-6 are presented.
Transl. By F.O.S.

N80-32420# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. of Studies and Research in Space Technology.
SATELLITE SPACECRAFT CHARGING CONTROL MATERIALS Interim Scientific Report, 1 Sep. 1978 - 30 Apr. 1980
B. Benaissa, L. Levy, A. Paillous, and D. Sarrail Wright-Patterson AFB, Ohio AFML Apr. 1980 141 p refs
(Grant AF-AFOSR-3704-78; AF Proj. 2422)

(AD-A087675; NERA/CERT/DERTS-CR-AF-05; AFWAL-TR-80-4029) Avail: NTIS HC A07/MF A01 CSCL 22/2

The feasibility of conductive adhesive techniques for the electrical interconnection of ITO-coated second surface mirrors has been studied. The good electrostatic performance and the durability of components combining ITO coated aluminized Kapton and aluminum straps by means of a silver loaded silicone have been confirmed by a prequalification program. The charge dissipation mechanisms for silica fabrics in a geosynchronous magnetic substorm environment have been studied by means of various sample configurations that have been tested under electron beam. Some recommendations have been given for a better use of silica fabrics as thermal control coatings in space. GRA

N80-32421# Naval Research Lab., Washington, D. C.
A DEMONSTRATION OF SATELLITE SHIELDING
J. B. Langworthy 22 Jul. 1980 26 p
(RR0120141)
(AD-A087752; AD-E000500; NRL-MR-4275) Avail: NTIS HC A03/MF A01 CSCL 22/2

A capability of performing electron shielding design for a real satellite is demonstrated by first posing a typical shielding problem and then solving it using the recently developed codes, SECTOR and BRANDE. In the process a modeling technique is introduced which allows conceptualizing the geometrical complexities of satellites in such a way that the shielding problem is made more methodical than the previous approach, a series of trials and corrections. GRA

N80-32422# Naval Postgraduate School, Monterey, Calif.
GUIDANCE AND CONTROL OF TACTICAL MISSILES M.S. Thesis
Thomas Alan Grote Dec. 1979 174 p refs
(AD-A085147) Avail: NTIS HC A08/MF A01 CSCL 16/2

The functioning program used to investigate the impact miss distance for the Supersonic Tactical Missile was modified. When the initial y-displacement error exceeded 1800 feet, the missile did not acquire the target. All errors smaller than this resulted in miss distances within 0.5 feet of the target. The midcourse guidance reference altitude was changed to reflect a sea-skimming missile. This simulation ran and impact was recorded. An attempt at adding random noise to the homing seeker was tried, but revealed that more information is required on this topic. The computer program was successfully converted and altered to run using the simplified ramjet model. T.M.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation.

N80-32423* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGICAL INNOVATION IN THE DESIGN AND DEVELOPMENT OF THE SPACE TRANSPORTATION SYSTEM
10 Sep. 1980 28 p
(NASA-TM-82190; PB0-10155) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

A general overview of the space transportation system is presented including a description of its intended operations and launch schedules. The advantages of using graphite epoxy and titanium/boron composite structures are examined as well as the capabilities of the thermal protection tiles. Technological advances used in the construction of the orbiter, the external tank, the solid rocket booster, and the main engine are assessed. Particular emphasis is given to computer controlled engine operations and the fly by wire system. A.R.H.

N80-32424* National Aeronautics and Space Administration, Washington, D. C.
SPACE SHUTTLE PRESS CONFERENCE
1 Aug. 1980 24 p
(NASA-TM-82191; PB0-10156) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

Details of the launch schedule for the first space transportation system flight are examined as well as solutions to problems related to the thermal protection system of the space shuttle main engine. Plans for rollout, to movement to the vehicle assembly building pad and flight readiness firing are considered, and the rationale for not flying the manned maneuvering unit is given. Manpower used in tile densification, the influence of DOD needs on the scheduling, prime contractor responsibilities, the role of Mission Control, and the differences between the orbiter and the space suit oxygen supply systems are also discussed. A.R.H.

N80-32425*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
MATED VERTICAL GROUND VIBRATION TEST
Edward W. Ivey Jul. 1980 96 p refs
(NASA-TM-78298) Avail: NTIS HC A05/MF A01 CSCL 22B

The Mated Vertical Ground Vibration Test (MVGVT) was considered to provide an experimental base in the form of structural dynamic characteristics for the shuttle vehicle. This data base was used in developing high confidence analytical models for the prediction and design of loads, pogo controls, and flutter criteria under various payloads and operational missions. The MVGVT boost and launch program evolution, test configurations, and their suspensions are described. Test results are compared with predicted analytical results. L.F.M.

N80-32426*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
USER'S GUIDE FOR THE FLIGHT DESIGN SYSTEM (FDS)
H. Rudy Ramsey, Michael E. Atwood, William G. Frisius, Althea A. Turner, and John K. Willoughby Aug. 1980 120 p Prepared in cooperation with Science Applications, Inc., Englewood, Colo. (Contract NAS9-15535)
(NASA-TM-82202; JSC-16794; IN-80-FM-47) Avail: NTIS HC A06/MF A01 CSCL 22A

Information about the Flight Design System (FDS) in the context of flight design is presented. The guide introduces the FDS user to the structure of FDS and to constructs within FDS (such as files of information or the part of FDS which interacts directly with the user). A guide to the commands available to FDS users is presented. A glossary of important terms, an index to terms, and a quick reference to the commands of FDS are included. T.M.

N80-32427*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 1: GROUND RULES AND CONSTRAINTS CYCLE 3.1.1
Jul. 1980 42 p refs Supersedes JSC-14483
(NASA-TM-82200; JSC-14483; JSC-16683-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The ground rules and constraint to be used in generating the Space Transportation System 1 Flight operational flight profile are established. A brief summary of the flight is also presented. L.F.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also 04 Aircraft Communications and Navigation and 32 Communications.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-32428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODELLING OF ENVIRONMENTALLY INDUCED DISCHARGES IN GEOSYNCHRONOUS SATELLITES
N. John Stevens 1980 9 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Ithaca, N.Y., 15-18 Jul. 1980; sponsored by IEEE
(NASA-TM-81598; E-581) Avail: NTIS HC A02/MF A01 CSCL 22B

The NASCAP computer code was used to compute the charging and discharging characteristics of a typical communications satellite in geosynchronous orbit. For the case of a severe substorm satellite surface differential charging in sunlight was found to be substantially less than that required to produce discharges in ground simulation studies. A discharge process was postulated involving discharges triggered at edges (or imperfection) followed by discharges to space. The characteristics of such discharges was parametrically varied to evaluate the possible effects on the satellite. Results indicated that discharge characteristics inferred from satellite monitors could be caused by predicted space discharges, that single cell discharges to space can reduce surface potentially over entire satellite, and that low density electron trajectory computations indicate that discharge generated electrons do not return to the satellite by long trajectories. Current transients predicted do not agree with available ground simulation results indicating that additional work must be done both analytically and experimentally to understand and fully explain these discrepancies. R.C.T.

N80-32429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF THE REENTRY FLIGHT DYNAMICS SIMULATOR FOR EVALUATION OF SPACE SHUTTLE ORBITER ENTRY SYSTEMS
Lawrence F. Rowell, Richard W. Powell, and Howard W. Stone, Jr. Washington Oct. 1980 97 p refs
(NASA-TP-1700; L-13662) Avail: NTIS HC A05/MF A01 CSCL 14B

A nonlinear, six degree of freedom, digital computer simulation of a vehicle which has constant mass properties and whose attitudes are controlled by both aerodynamic surfaces and reaction control system thrusters was developed. A rotating, oblate Earth model was used to describe the gravitational forces which affect long duration Earth entry trajectories. The program is executed in a nonreal time mode or connected to a simulation cockpit to conduct piloted and autopilot studies. The program guidance and control software used by the space shuttle orbiter for its descent from approximately 121.9 km to touchdown on the runway. T.M.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-32430*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
FEASIBILITY OF MODIFYING THE HIGH RESOLUTION INFRARED RADIATION SOUNDER (HIRS/2) FOR MEASURING SPECTRAL COMPONENTS OF EARTH RADIATION BUDGET Final Report
Edward W. Koenig and Kent A. Holman Aug. 1980 80 p
(Contract NAS1-16180)
(NASA-CR-159353) Avail: NTIS HC A05/MF A01 CSCL 14B

The concept of adding four spectral channels to the 20 channel HIRS/2 instrument for the purpose of determining the origin and profile of radiant existence from the Earth's atmosphere is considered. Methods of addition of three channels at 0.5, 1.0 and 1.6 micron m to the present 0.7 micron m visible channel and an 18-25 micron m channel to the present 19 channels spaced from 3.7 micron m to 15 micron m are addressed. Optical components and physical positions were found that permit inclusion of these added channels with negligible effect on the performance of the present 20 channels. Data format changes permit inclusion of the ERB data in the 288 bits allocated to HIRS for each scan element. A lamp and collimating optic assembly may replace one of the on board radiometric black bodies to provide a reference source for the albedo channels. Some increase in instrument dimensions, weight and power will be required to accommodate the modifications. A.R.H.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-32431*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
31 Jul. 1980 45 p
(Contract NAS8-33444)
(NASA-CR-161563; FR-13168-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 21H

The orbit transfer vehicle (OTV) engine study provided parametric performance, engine programmatic, and cost data on the complete propulsive spectrum that is available for a variety of high energy, space maneuvering missions. Candidate OTV engines from the near term RL 10 engine to advanced high performance expander engines were examined. T.M.

N80-32432*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 2: TECHNICAL REPORT Final Report
31 Jul. 1980 206 p
(Contract NAS8-33444)
(NASA-CR-161564; FR-13168-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 21M

The orbit transfer vehicle (OTV) engine study provided parametric performance, engine programmatic, and cost data on the complete propulsive spectrum that is available for a variety of high energy, space maneuvering missions. Candidate OTV engines from the near term RL 10 (and its derivatives) to advanced high performance expander and staged combustion cycle engines were examined. The RL 10/RL 10 derivative performance, cost and schedule data were updated and provisions defined which would be necessary to accommodate extended low thrust operation. Parametric performance, weight, envelope, and cost data were generated for advanced expander and staged combustion OTV engine concepts. A prepoint design study was conducted to optimize thrust chamber geometry and cooling, engine cycle variations, and controls for an advanced expander engine. Operation at low thrust was defined for the advanced expander engine and the feasibility and design impact of kitting was investigated. An analysis of crew safety and mission reliability was conducted for both the staged combustion and advanced expander OTV engine candidates. T.M.

N80-32433*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ORBIT TRANSFER VEHICLE ENGINE STUDY. VOLUME 3: PROGRAM COSTS Final Report

31 Jul. 1980 45 p
(Contract NAS8-33444)
(NASA-CR-161574; PWA-FR-13168-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 21H

Budgetary and planning cost estimates are presented that were prepared for the development, production and operation and flight support phases for each of the engines proposed for OTV propulsion. The major features of each category engine are described. The development program estimates were structured to the preliminary program Work Breakdown Structures (WBS). Program costs are provided within the applicable WBS elements to Level 4 for each category engine. The production program cost estimates assume a first production lot of 50 units produced at a rate of two units per month. Cumulative average unit costs assume a 90% learning capability. The operations and flight support cost estimates are based on 15, 30 and 45 missions per year for the period 1988 through 1999. Estimated funding requirements were developed for each category and program phase. All cost estimates and funding data are presented in 1979 dollars. The assumptions and ground rules for these estimates are summarized. A.R.H.

N80-32434# Tennessee Univ. Space Inst., Tullahoma. Gasdynamics Div.
PHOTOGRAPHIC SPECTROSCOPIC MEASUREMENT OF ULTRAVIOLET SOLID ROCKET MOTOR PLUMES Final Report
Dennis R. Keefer, William J. Phillips, and Kenneth E. Harwell 7 Feb. 1980 17 p refs
(Contract N60530-78-C-0020; ZF32392002)
(AD-A088438; UTSI-GD-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 17/5

Photographic spectra having a nominal bandpass of 0.4 nm were obtained from the radiation from several solid rocket motor exhausts in the spectral region 250 nm to 430 nm. The spectra consisted primarily of a continuum with some molecular band structure which was found to originate from the molecules OH, PsO, NO CHO. These molecular bands were more pronounced in the region 290 nm to 320 nm, but the radiating systems involved extend to shorter wavelengths. The source of the continuum radiation was not determined explicitly, but is not inconsistent with a CO and O recombinations mechanism. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-32435* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RADIANT PANEL TESTS ON AN EPOXY/CARBON FIBER COMPOSITE
R. Ballard, D. E. Cagliostro, M. Gross, Ming Ta Hsu, and W. Winslow Mar. 1980 41 p refs Prepared in cooperation with San Jose State Univ., California
(NASA-TM-81185; A-8110) Avail: Issuing Activity CSCL 07B

The toxicity of epoxy/carbon fiber composites in fire environments is addressed. A radiant panel test chamber was developed to study the effects of pyrolysis of polymeric materials. The thermal response of the sample and the composition of gas and aerosol produced are determined. Toxicological effects of the gas and aerosol in the chamber are determined by studying changes in cardiac action, respiration, blood enzymes, and delayed escape responses in test animals. Data are presented for pyrolysis of an epoxy/carbon fiber composite at 2.5 W/sq cm. Nonflame and flame modes produced different gas and aerosol compositions and had different toxic effects. Nonflame modes produced large quantities of organic aerosols and carbon monoxide. These were not lethal but could hinder escape and may pose a long term toxic effect. The flame condition produced hydrogen cyanide in addition to other toxic products. M.G.

N80-32436# New York Univ., N. Y. Dept. of Physics.
INTERACTION OF RADIATION WITH MATTER. Proposed Technical Program, 1 Nov. 1979 - 31 Oct. 1980
Werner Brandt and M. Pope Oct. 1979 15 p refs
(Contract DE-AS02-79EV-02386)
(DOE/EV-02386/1) Avail: NTIS HC A02/MF A01

Summaries of research activities are presented. Areas of study include: environmental; photophysics; spectroscopic studies of polycyclic aromatic hydrocarbon carcinogen DNA complexes; reactions of polycyclic aromatic hydrocarbons adsorbed on metal oxide particles in the presence of oxygen and other pollutant gases; energy loss effect in inner shell excitations; very low velocity Coulomb deflection effects in K and L shell excitations; development of high vacuum target chamber for acceleration studies of low energy ion solid interactions; dynamic response of solids to slow ions; wakes in solids; statistical mechanics of particles in constrained area; and stopping power of nearly degenerate media. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-32437# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
A MICRODEBONDING TEST FOR IN-SITU FIBER-MATRIX BOND STRENGTH AND MOISTURE EFFECTS
J. F. Mandell, J-H. Chen, and F. J. McGarry Feb. 1980 26 p refs
(Contract DAAG46-77-C-0770)
(RBO-1) Avail: NTIS HC A03/MF A01

A test technique which gives a quantitative measure of the in situ fiber/matrix bond strength in composites is described. The test involves the compressive loading of a fiber or region of fibers on a polished specimen surface to produce debonding. Results are given for the debonding load for glass, aramid and graphite/epoxy composites. The change in debonding load is followed as the interface degrades during moisture conditioning at different points through the thickness. Refinements are needed to simplify interpretation of the debonding force in terms of interface shear strength, and to make the test more reproducible. S.F.

N80-32438# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
FRACTURE TESTING OF INJECTION MOLDED GLASS AND CARBON FIBER REINFORCED THERMOPLASTICS
J. F. Mandell, A. Y. Darwish, and F. J. McGarry Nov. 1979 38 p refs Sponsored by the Lord Corp.
(MIT-CE-R79-4) Avail: NTIS HC A03/MF A01

Polycarbonate, polysulfone, Nylon 6/6, polyphenylene sulfide and poly(amide-imide) samples containing either 40 percent graphite or 30-40 percent glass fibers were tested for fracture toughness, using linear elastic fracture mechanics methods. SEN specimens consistently positioned in centergated injection molded plaques gave KQ values insensitive to C/W ratio. These ranged from 2.8 to 10.5 (MNm)-3/2 reflecting the strong effects of fiber orientation. The toughness values of ductile and brittle matrices, greatly different when unreinforced, converged to similar levels (7-9(MNm)-3/2), with the addition of either fiber. A correlation between crack tip plastic zone size and longest fiber length appeared consistent with the dominant crack propagation mode which emphasized fiber avoidance: matrix and interface rather than fiber fracture. Author

N80-32439*# United Technologies Research Center, East Hartford, Conn.
COATINGS FOR GRAPHITE FIBERS Final Report
F. S. Galasso, D. A. Scola, and R. D. Veltri Aug. 1980 104 p refs
(Contract NAS1-14346)
(NASA-CR-159304; RBO-914212-22) Avail: NTIS HC A06/MF A01 CSCL 11D

Graphite fibers released from composites during burning or an explosion caused shorting of electrical and electronic equipment. Silicon carbide, silica, silicon nitride and boron nitride were coated on graphite fibers to increase their electrical resistances. Resistances as high as three orders of magnitude

higher than uncoated fiber were attained without any significant degradation of the substrate fiber. An organo-silicone approach to produce coated fibers with high electrical resistance was also used. Celion 6000 graphite fibers were coated with an organo-silicone compound, followed by hydrolysis and pyrolysis of the coating to a silica-like material. The shear and flexural strengths of composites made from high electrically resistant fibers were considerably lower than the shear and flexural strengths of composites made from the lower electrically resistant fibers. The lower shear strengths of the composites indicated that the coatings on these fibers were weaker than the coating on the fibers which were pyrolyzed at higher temperature. T.M.

N80-32440*# United Technologies Research Center, East Hartford, Conn.

RESEARCH ON GRAPHITE REINFORCED GLASS MATRIX COMPOSITES Interim Report, Jun. 1978 - Feb. 1980

K. M. Prewo and E. R. Thompson Feb. 1980 95 p refs

(Contract NAS1-14346)

(NASA-CR-159312; R80-912545-49) Avail: NTIS HC A05/MF A01 CSCL 11D

High levels of mechanical performance in tension, flexure, fatigue, and creep loading situations of graphite fiber reinforced glass matrix composites are discussed. At test temperatures of up to 813 K it was found that the major limiting factor was the oxidative instability of the reinforcing graphite fibers. Particular points to note include the following: (1) a wide variety of graphite fibers were found to be comparable with the glass matrix composite fabrication process; (2) choice of fiber, to a large extent, controlled resultant composite performance; (3) composite fatigue performance was found to be excellent at both 300 K and 703 K; (4) composite creep and stress rupture at temperatures of up to 813 K was limited by the oxidative stability of the fiber; (5) exceptionally low values of composite thermal expansion coefficient were attributable to the dimensional stability of both matrix and fiber; and (6) component fabricability was demonstrated through the hot pressing of hot sections and brazing using glass and metal joining phases. R.K.G.

N80-32441*# Brown Univ., Providence, R. I. Div. of Engineering.

EFFECT OF PROCESSING PARAMETERS ON REACTION BONDING OF SILICON NITRIDE

Marc H. Richman, Otto J. Gregory, and Matthew B. Magida Oct. 1980 127 p refs

(Grant NsG-3118)

(NASA-CR-163579) Avail: NTIS HC A07/MF A01 CSCL 11D

Reaction bonded silicon nitride was developed. The relationship between the various processing parameters and the resulting microstructures was to design and synthesize reaction bonded materials with improved room temperature mechanical properties. T.M.

N80-32442*# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

STABILITY OPTIMIZATION OF LAMINATED COMPOSITE PLATES

Yoichi Hirano Jul. 1980 19 p refs

(Grant NGL-33-018-003)

(ISAS-579-Vol-45-No-4; NASA-CR-163456) Avail: NTIS HC A02/MF A01 CSCL 11D

The optimum design of plates with orthotropic layers under axial compression and shear is discussed. The plates considered are the laminates of N orthotropic layers whose principal material axes coincide with the plate axes. Each layer is assumed to have the same thickness and an equal number of fibers in the direction of + alpha sub i and - alpha sub i with respect to the plate axis. The fiber directions which give the highest axial buckling stress and the highest shear buckling stress are found by utilizing a mathematical optimization technique for various aspect ratios of the plates. Inhomogeneity in the direction of the plate thickness (stacking sequence) is taken into account in this analysis. Author

N80-32443# Naval Surface Weapons Center, Dahlgren, Va.

DETERMINATION OF KINETIC PARAMETERS FOR THERMAL DECOMPOSITION OF PHENOLIC ABLATIVE MATERIALS BY MULTIPLE HEATING RATE METHOD Final Report

J. B. Henderson, J. A. Wiebelt, M. R. Tant, and G. R. Moore Jul. 1980 33 p refs

(ZR0000101)

(AD-A087929; NSWC/TR-80-204) Avail: NTIS HC A03/MF A01 CSCL 07/3

The rate of decomposition for two widely used glass- and asbestos-phenolic ablative materials were measured using standard thermogravimetric techniques. Thermograms were obtained at six heating rates ranging from 10 degrees C/min to 160 degrees C/min. From these data, the kinetic parameters were determined by a slightly modified version of Friedman's method. Fractional weight loss calculated using the derived kinetic parameters over the temperature range of decomposition agreed with measured values with a mean error of 0.33 and 0.28 percent, with a standard deviation of errors 0.58 and 0.84 percent for glass and asbestos-phenolic, respectively. The 95 percent confidence for the mean error was 0.22 and 0.44 percent for the glass-phenolic and 0.14 and 0.42 percent for the asbestos-phenolic. Also, the activation energy was calculated by the Flynn and Wall method. The average activation energy values determined by the two methods agreed within 4.6 percent for both materials. GRA

N80-32444# Electronics Research Lab., Adelaide (Australia).

STRESS IN POROUS THIN FILMS THROUGH ADSORPTION OF POLAR MOLECULES

E. H. Hirsch Mar. 1980 27 p refs

(AD-A087770; ERL-0124-TR; AR-001-952) Copyright. Avail: NTIS HC A03/MF A01 CSCL 11/6

Films of magnesium fluoride are found to be under large tensile stress following exposure to water vapor. It is shown that this stress, which varies reversibly in magnitude with the adsorption equilibrium, can be attributed to electrostatic dipole interaction between the adsorbed water molecules. The effect is not confined to magnesium fluoride, but can occur in other materials of an appropriate porous structure. Its relevance to the stability of optical coatings is discussed, together with some other applications. GRA

N80-32445# Lockheed-California Co., Burbank.

EFFECT OF LOAD HISTORY ON FATIGUE LIFE Final Technical Report, 30 Aug. 1978 - 31 Dec. 1979

J. T. Ryder Wright-Patterson AFB, Ohio AFML Jun. 1980 261 p refs

(Contract F33615-78-C-5090; AF Proj. 2419)

(AD-A088439; LR-29586; AFWAL-TR-80-4044) Avail: NTIS HC A12/MF A01 CSCL 11/4

The primary objectives of this program are to: 1) study in detail how mechanical loading parameters affect the fatigue life of graphite/epoxy laminates; 2) determine the effects of environmental and geometrical perturbations on the effects studied in objective 1; 3) analyze the results in a manner such that an expanded foundation is laid for formulating fatigue life models based on knowledge of failure mechanisms. The research investigation is divided into four tasks: Task 1, Diagnostic Experimentation; Task 2, Effects of Loading Parameters; Task 3, Effects of Environment and Geometry; Task 4, Data Analysis and Reporting. Tasks 1, 2 and 3 are conducted sequentially while Task 4 is conducted simultaneously with all three tasks. This report describes the analytical and experimental work undertaken in Task 1. GRA

N80-32446# Prototype Development Associates, Inc., Santa Ana, Calif.

AN ANALYSIS OF INTERLAMINAR STRESS GRADIENTS AND IMPACT DAMAGE IN GRAPHITE-EPOXY LAMINATES Final Report, Jan. 1977 - Jan. 1978

E. L. Stanton and L. M. Crain Mar. 1980 86 p refs

(Contract N62269-77-C-0144)

(AD-A088317; NADC-80135-60; PDA-TR-5268-00-01) Avail: NTIS HC A05/MF A01 CSCL 11/4

Interlaminar stress gradients caused by an internal disbond and by low velocity impact are analyzed using 3D finite elements. The disbonded [0/+ or - 45/0211-45/45/0] laminate warps out of plane under or biaxial compression without large stress gradients. A much thicker 48 ply laminate [+ or - 45/02/+ or - 45/02/+ or - 45/0/90]2S is analyzed for impact by a

steel sphere that strikes the laminate off center. Large subsurface shear stresses occur around the perimeter of the contact area with a sinusoidal distribution. These results were obtained using the PATCHES-III program with new constraint elements for modeling laminates. GRA

N80-32447# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
FLAW DETECTION AND EVALUATION OF COMPOSITE CYLINDERS USING LASER SPECKLE INTERFEROMETRY AND HOLOGRAPHY
Terry L. Vandiver 23 Nov. 1979 88 p refs
(AD-A088206; AD-E950017; DRSMI-RL-80-7-TR) Avail: NTIS HC A05/MF A01 CSCL 14/2

The objective of this work was to determine what constitutes a flaw in a composite tube. Speckle interferometry and holography were used to measure surface displacements of 108 fiber reinforced thin wall cylinders. E-glass, S-glass and Kevlar fibers were used. Cut fiber and impact flaws were investigated. A new automated laser speckle interferometry displacement contour analyzer was used in conjunction with a computer for data analysis. The system analyzes 5000 data points in less than four minutes. Full field reconstruction of laser speckle interferograms and holograms is presented. The techniques described give the investigator a full field displacement picture of the flawed structures as well as displacement data that can be used to determine stresses and strains. GRA

N80-32448# Little (Arthur D.), Inc., Cambridge, Mass.
A REVIEW AND ANALYSIS OF FIBER COUNTING METHODS Final Report
Jun. 1980 55 p
(Contract N60921-78-C-0221; W06520000)
(AD-A088240; NSWC/TR-80-210) Avail: NTIS HC A04/MF A01 CSCL 11/5

Fiber counting methods for use with carbon fibers are reviewed and analyzed. Recommendations are made for their use and comparison. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-32449# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
CHEMICAL, SPECTRAL, STRUCTURAL, AND CHARGE TRANSPORT PROPERTIES OF THE MOLECULAR METALS PRODUCED BY IONIZATION OF NICKEL PHTHALOCYANINE Interim Report
Raymond P. Scaringe, Charles J. Schramm, Djordje R. Stojakovic, Brian M. Hoffman, James A. Ibers, and Tobin J. Marks 17 Jul. 1980 72 p refs Submitted for publication
(Contract N00014-77-C-0231; Grants NSF DMR-76-80847-A01; NSF DMR-77-26409; NR Proj. 053-640)
(AD-A087553; TR-11) Avail: NTIS HC A04/MF A01 CSCL 07/3

Partial oxidation of metallophthalocyanines with iodine has provided an extensive new class of molecular conductors. As illustrated in the present case with nickel phthalocyanine, the properties of the resulting solid state array of pi-cation radicals include electrical conductivity which is comparable with that of the best-known stacked molecular conductors. A particularly intriguing feature of NiPcI1.0 charge transport is a transition from metallic to semi-conducting behavior which apparently is not reflected in the magnetic properties of the carriers. It is tempting to speculate that this behavior reflects a change in carrier mobility brought about by some subtle structural rearrangement such as a change in the ordering of the triodide chains. In a broader perspective, the iodinated metallophthalocyanines, such as those reported here, represent the first entry into a widening area of conductive materials based upon the ligand pi systems of mixed-valent metallo-macrocyclic arrays. Clearly the insights gleaned and the methodology developed will lead to an ever-deepening understanding of those molecular characteristics which facilitate charge conduction and which optimize materials performance. GRA

N80-32450# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
THE QUANTUM DYNAMICS OF CHEMICAL REACTIONS Final Scientific Report, 1 Jun. 1977 - 30 Jun. 1979
Aron Kuppermann 14 Mar. 1980 22 p refs
(Contract AF-AFOSR-3394-77; AF Proj. 2303)
(AD-A084243; AFOSR-80-0292TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Accurate and approximate quantum dynamical calculations were made on elementary chemical reactions of importance for the fundamental aspects of chemical dynamics and for advanced technologies of interest to the United States Air Force, such as high energy chemical lasers, plume technology, and the chemical effects of high energy radiation. These included calculations of three atom exchange reactions breakup collisions, three body recombinations vibrational quenching by reaction, tunneling, and eletronic branching ratios. The aim of these calculations was to develop an understanding of these processes and to develop benchmark data against which approximate methods may be tested. R.C.T.

N80-32451# Wisconsin Univ. - Madison. Dept. of Chemistry.
LUMINESCENT TELLURIUM-DOPED CADMIUM SULFIDE ELECTRODES AS PROBES OF SEMICONDUCTOR EXCITED-STATE DEACTIVATION PROCESSES IN PHOTOELECTROCHEMICAL CELLS
Arthur B. Ellis, Bradley R. Karas, and Holger H. Streckert 12 Aug. 1980 30 p refs Submitted for publication
(Contract N00014-78-C-0633; NR Proj. 051-690)
(AD-A088532; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Correlations between quantum efficiencies for photocurrent (phi (x)), emission (phi r), and nonradiative recombination (phi (nr)) are discussed with reference to data from single-crystal, n-type, 100 and 1000 ppm CdS:Te-based photoelectrochemical cells (PECs) employing aqueous sulfide electrolyte. These materials emit while they serve as PEC electrodes. The assumption that the proportionality of phi (r) to phi (nr) is unaffected by potential leads to a simple expression relating phi (x) to phi (r) for monochromatic excitation. Calculated and observed emission data are in reasonable agreement; sources of deviation are discussed. Polychromatic excitation is shown to yield photocurrent and emission intensity which is approximately a weighted average of the values obtained with the constituent monochromatic frequencies. Practical implications of the phi (x) correlation with phi (r) are described, as are related results from other PECs. GRA

N80-32452# California Univ., Santa Barbara. Dept. of Physics and Chemistry.
SULFUR MODIFIES THE CHEMISORPTION OF CARBON MONOXIDE ON RHODIUM/ALUMINA MODEL CATALYSTS
R. M. Kroeker, W. C. Kaska, and P. K. Hansma 29 Jul. 1980 15 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088043; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

The effect of D2 S on the chemisorption of CO on supported rhodium is examined with tunneling spectroscopy. It is seen that for low concentrations, D2 S decreases the density of species with two CO molecules per Rh atom and increases the density of species with one CO molecule per Rh atom. At higher concetrations D2 S decreases the density of all types of adsorbed CO. GRA

N80-32453# IBM Research Lab., San Jose, Calif.
VIBRATIONAL SPECTRA OF CARBON MONOXIDE CHEMISORBED ON ALUMINA-SUPPORTED NICKEL

PARTICLES: A TUNNELING SPECTROSCOPY STUDY
R. M. Kroeker, W. C. Kaska, and P. K. Hansma 29 Jul. 1980 24 p refs Submitted for publication Prepared in part by California Univ., Santa Barbara
(Contract N00014-78-C-0011)
(AD-A088044; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

Tunneling spectroscopy is used to study the chemisorption of CO on small nickel particles. The particles are grown from vapor on a thermally oxidized aluminum substrate. Carbon monoxide is observed to chemisorb in at least four distinct ways, giving CO stretching frequencies of 256.5, 246, 222 and 207 meV. The 256.5 meV species has low frequency modes at 45.5 and 59.5 meV. The low frequency modes of the remaining three species are not resolved sufficiently for identification. The frequencies of all modes were found to have some coverage dependence. The largest shift is seen in a CO stretching vibration that moves from 200 to 207 meV with increasing coverage. The effect of H2 co-adsorption is examined and evidence for the presence of oxygen on the particles is presented. The reaction of the chemisorbed CO with H2 on these nickel particles is found to produce very little surface hydrocarbon in contrast to results found previously for rhodium particles under similar conditions. GRA

N80-32454# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.
IDENTIFICATION AND QUANTIFICATION OF HYDROCARBON PRODUCTS IN EFFLUENTS Interim Report
R. S. Vogel, W. J. Mikucki, R. J. Fileccia, and R. G. Lampo May 1980 62 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A088268; CERL-IR-N-91) Avail: NTIS HC A04/MF A01 CSCL 07/3

This report documents interim results of a study to (1) investigate the capability of infrared (IR) spectroscopy for the identification of specific hydrocarbon products in effluents from washracks and other vehicle service operations at Army installations, and (2) make a comparative evaluation of the Environmental Protection Agency's (EPA) gravimetric (STORET 00556) and IR (STORET 00560) methods of quantifying 'total hydrocarbons' in wastewater. Results have shown that IR spectroscopy can provide a basis for the identification of hydrocarbon products for which reference samples are available. In the initial phase of the work, a scheme of sequential discriminant analysis and pattern recognition was used with reference to a file of military specification (MIL SPEC) hydrocarbon products used in servicing wheel and track type Army vehicles. The complexity of IR data reduction was shown to increase rapidly with the number of hydrocarbon products present in a given sample, a result of a similarity in the hydrocarbon components' molecular structure. The use of gas liquid chromatography (GLC) in conjunction with IR spectroscopy provided additional discrimination and simplified data reduction. A comparative investigation of the gravimetric vs IR methods for the quantification of 'total hydrocarbons' in wastewater showed that the IR method was capable of higher precision than the gravimetric method at hydrocarbon concentrations less than 10 mg/l, and could provide information on chemical composition and consequently the origin of the hydrocarbon product. GRA

N80-32455# Naval Research Lab., Washington, D. C.
OPTO-ACOUSTIC STUDIES OF METHANE IMPURITIES IN ARGON Memorandum Report, Oct. 1978 - Oct. 1979
D. H. Leslie and G. L. Trusty 30 Jul. 1980 26 p refs
(AD-A088053; NRL-MR-4283) Avail: NTIS HC A03/MF A01 CSCL 07/4

An optoacoustic detection system has been constructed for detecting absorption of DF laser radiation. Absorption by methane in argon has been observed at 13 DF lines. The system was calibrated using independently measured absorption line parameters for CH4 broadened by argon at the DF line P sub 8. GRA

N80-32456# Rhode Island Univ., Kingston. Dept. of Mathematics.
A COLLINEAR N-BODY PROBLEM OF CLASSICAL ELECTRODYNAMICS Interim Report
R. D. Driver and M. J. Norris May 1980 10 p refs Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract F49620-79-C-0129; DE-AC04-76DP-00789; AF Proj. 2304)
(AD-A088114; AFOSR-80-0586TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

A model for the motion of n charged particles on the x-axis is described which leads to a system of delay differential equations with delays dependent on the unknown trajectories. If appropriate past histories of the trajectories are given, say on a,0, then for sufficiently small $t > or = 0$ there is a system of n(2) ordinary differential equations of the form $y' = f(t,y)$ with $y(0) = y$ sub 0 given. A generalized Lipschitz type condition is developed which is satisfied in the electrodynamics case. It is demonstrated that solutions of the equations of motion exist and are unique as long as no two particles collide. M.G.

N80-32457# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
THE APPLICATION OF HIGH RESOLUTION ELECTRON ENERGY LOSS SPECTROSCOPY TO THE STUDY OF MODEL SUPPORTED METAL CATALYSTS
L. H. Dubois, P. K. Hansma, and G. A. Somorjai 29 Jul. 1980 27 p refs Submitted for publication Supported in part by NSF
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088118; LBL-10733; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07/4

Model supported metal catalysts were fabricated by evaporating a small quantity of rhodium onto an oxidized aluminum substrate. High resolution electron energy loss spectroscopy (ELS) was successfully used to obtain the vibrational spectra of carbon monoxide chemisorbed on these model catalysts. The ELS spectra are compared with vibrational spectra obtained by infrared spectroscopy and inelastic electron tunneling spectroscopy for CO chemisorbed on similar model catalysts. GRA

N80-32458# Oxford Univ. (England). Inorganic Chemistry Lab.
ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY OF VANADIUM (IV) COMPLEXES AND RELATED SPECIES Final Scientific Report, 1 Oct. 1977 - 31 Jul. 1980
Kenneth R. Seddon and P. Roger Dixon 27 Jul. 1980 109 p refs
(Grant AF-AFOSR-3368-77; AF Proj. 2301)
(AD-A088311; EOARD-TR-80-13) Avail: NTIS HC A06/MF A01 CSCL 07/4

The application of electron paramagnetic resonance (EPR) spectroscopy to the study of vanadium (IV) oxohalide complexes is discussed. The method is proved to be an invaluable structural tool for relating the structure of a complex in an amorphous or polycrystalline sample to that of the same complex in solution. Moreover, solution studies by (EPR) reveal previously unsuspected dissociation and displacement phenomena for complexes of the type /VOX sub 2 L sub n/(X = Cl or Br, L = mono- or bi-dentate ligand). M.G.

N80-32459# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
COMPOSITION AND TEMPERATURE DEPENDENCE OF SHEAR VISCOSITY OF HYDROCARBON MIXTURES Final Technical Report, 1 Jun. 1979 - 31 May 1980
M. Adel-Hadadi, A. V. Lesikar, and C. Moynihan Jul. 1980 108 p refs
(Contract N00019-79-C-0329)
(AD-A088236) Avail: NTIS HC A06/MF A01 CSCL 07/3

Shear viscosities and densities have been measured from 50 C to as low as -56 C for five C10 hydrocarbons: n-decane, n-butyl cyclohexane, cis-decalin, n-butyl benzine and 2,7-dimethyl octane and their mixtures. A literature review of theories of hydrocarbon mixture viscosities has been carried out. It is shown that previous theories, in general, cannot give a good account of the mixture viscosities over the wide temperature range covered in this study. Two simple semiempirical equations have been developed and applied to the description of the combined composition temperature dependence of the viscosity of both the hydrocarbons studied under the present contract and two polycyclic hydrocarbons studied under a parallel Air Force Contract.

The equations assume additivity of component free volumes in the mixtures and contain no more adjustable parameters than are required to account for the viscosities of the pure hydrocarbon components. GRA

N80-32460# Washington Univ., Seattle. Dept. of Chemistry.
ERROR PROPAGATION AND OPTIMAL PERFORMANCE IN MULTICOMPONENT ANALYSIS Interim Technical Report
Clemens Jochum, Peter Jochum, (Ludwig-Maximilians-Univ., Munich), and Bruce R. Kowalski Aug. 1980 36 p refs Submitted for publication
(Contract N00014-75-C-0536; NR Proj. 051-565)
(AD-A088207; TR-17) Avail: NTIS HC A03/MF A01 CSCL 07/4

A study of error propagation for multicomponent analysis in the presence of sample related interferences by the generalized standard addition method has been made. The results of the examination have led to an alternate experimental design and optimal computation algorithms which are tested using a four component spectrophotometric analysis. Additionally, the theory describes fundamental constraints to multicomponent analysis in the presence of chemical, physical and spectral interferences. GRA

N80-32461# Indiana Univ. at Bloomington. Dept. of Chemistry.
A LINEAR RESPONSE THEORY APPROACH TO TIME-RESOLVED FLUORIMETRY Interim Technical Report
G. M. Hieftje and E. E. Vogelstein 18 Jul. 1980 54 p refs Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A088211; TR-26; TR-33) Avail: NTIS HC A04/MF A01 CSCL 07/4

A new conceptual and instrumental approach to time-resolved chemical measurements is presented. Based on the concepts of information and linear response theory, the new approach is applicable to a number of different areas, including nuclear magnetic resonance spectrometry, high-speed kinetic measurements, gas chromatographic analysis, and time-resolved luminescence spectrometry. In the particular examples given, the new approach is applied to the determination of luminescence lifetime. Accuracy and simplicity of the method are emphasized and its application to chemical analysis discussed. GRA

N80-32462# American Wind Energy Association, Washington, D.C.
CAPITAL FORMATION FOR SMALL WIND ENERGY CONVERSION SYSTEM MANUFACTURERS: A GUIDE TO METHODS AND SOURCES Final Report
Peter. H. Smeallie and Benjamin Wolff May 1980 55 p refs Prepared in cooperation with Vonier (Thomas) Associates, Inc., Washington, D.C.
(Contract EG-77-C-01-4042)
(SERI/TR-98298-1) Avail: NTIS HC A04/MF A01

Sources of capital are described and the development of a business plan explained. Case histories of four wind companies' experiences in raising capital are included. DOE

N80-32463# Oak Ridge National Lab., Tenn. Chemistry Div.
HYDROGEN EXCHANGE IN SOME COAL-RELATED REACTIONS AT 400 C
Ben M. Benjamin, M. J. Michalczyk (Knox Coll., Galesburg, Ill.), and M. C. Woody 1980 12 p refs Presented at the AICE Conf., Philadelphia, 8 Jun. 1980
(Contract W-7405-eng-26)
(CONF-800610-7) Avail: NTIS HC A02/MF A01

The kinetics of the transfer of hydrogen from tetralin and other hydrogen rich solvents, or groups in coal were studied using the pure compounds, 1,2-diphenylethane (bibenzyl), and diphenylmethane as models. Because the thermolysis of the compound gives some different products when heated alone or when heated in the presence of a good hydrogen donor, such as tetralin, it was of interest to know where the cleavage fragments derive their hydrogen to give the final product. In order to resolve this aspect of the reaction, bibenzyl was prepared completely deuterated (99.8%) in the dimethylene linkage, and pyrolyzed in the presence of ordinary tetralin. From the data it is concluded that the benzyl radical, formed by cleavage of bibenzyl, gives toluene by abstracting hydrogen from tetralin. The product after 1 percent conversion was PhCD2H. In fact, in this mixture, tetralin-bibenzyl-d4 at 400 C, deuterium is lost from benzyl by exchange 3 to 4 times faster than it undergoes carbon-carbon bond scission. Thus, the chemistry of bibenzyl at 400 C is dominated by hydrogen exchange reactions. DOE

N80-32484# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF A TEMPORALLY AND SPATIALLY RESOLVED GRAZING INCIDENCE SPECTROMETER
D. D. Dietrich, R. J. Fortner, D. F. Price, R. E. Stewart, C. Gilman (Physics International, Berkeley, Calif.), and H. Helava (Physics International, Berkeley, Calif.) 1980 13 p refs Presented at the 3d Topical Conf. on High Temp. Plasma Diagnostics, Los Angeles, 17 Mar. 1980
(Contract W-7405-eng-48)
(UCRL-83808; CONF-800320-5) Avail: NTIS HC A02/MF A01

Design considerations are presented for a grazing incidence spectrometer which will resolve both temporally and spatially the emission from a wide variety of plasmas. The basis of the design involves use of microchannel plates which are curved to conform to the Rowland circle to the spectrometer. The spectra are obtained when the anode is property biased. The use of multiple anodes allows gating and with appropriate delays results in sequential time resolution of a few nanoseconds. Simultaneous gating of the anodes with spatial resolution of less than 100 microns for any given time frame can also be obtained. The efficiency of this spectrometer is also compared with conventional grazing incidence spectrometers. DOE

N80-32485# Sandia Labs., Albuquerque, N. Mex.
APPLICATIONS OF HIGH RESOLUTION INVERSE RAMAN SPECTROSCOPY
Adelbert Owyoung and Peter Esherick 1980 19 p refs Presented at the 7th Intern. Conf. on Raman Spectry., Ottawa, 4 Aug. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0639C; CONF-800808-3) Avail: NTIS HC A02/MF A01

The use of high power, narrow band lasers significantly improved the resolving power and sensitivity of inverse Raman spectroscopy of gases. This technique, by showing some Q-branch spectra of heavy spherical tops is described. Some possible future applications are discussed. DOE

N80-32486# Los Alamos Scientific Lab., N. Mex.
ULTRA HIGH RESOLUTION INVERSE RAMAN SPECTROSCOPY OF METHANE IN A CW FREE EXPANSION JET
James J. Valentini, Peter Esherick, and Adelbert Owyoung 1980 4 p refs Presented at 11th Intern. Quantum Electron. Conf., Boston, 23 Jun. 1980 Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-1370C; CONF-800614-2) Avail: NTIS HC A02/MF A01

The feasibility of applying coherent Raman techniques to precise spectroscopic studies in molecular beams is addressed. An ultrahigh resolution inverse Raman spectrum of (12) CH4 was obtained in a cw free expansion jet in which the gas was cooled into a nonBoltzmann distribution of three rotational levels corresponding to the meta, para, and ortho nuclear spin states. DOE

N80-32487# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PULSE COMBUSTION TECHNOLOGY FOR HEATING APPLICATIONS Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
C. A. Blomquist, J. M. Clinch, and F. W. Ahrens Apr. 1980 28 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-85) Avail: NTIS HC A03/MF A01

The technology base for fossil fuel fired pulse combustion heating systems was developed. Design data and design procedures for pulse combustion burners were developed. This design capability contributes to the accelerated industrial

development of cost effective, high efficiency systems for a variety of heating applications. DOE

N80-32468# Ad-Ex International, Portola Valley, Calif.
QUANTITATIVE GAS ANALYSIS OF SULFUR DIOXIDE IN NITROGEN BY FOURIER TRANSFORM INFRARED SPECTROPHOTOMETER
Y. Koga, M. Sugie, S. Kondo, and S. Saeri Dec. 1979 21 p refs Transl. into ENGLISH from Bunseki Kagaku (Japan), v. 28, 1979 p 298-303 Sponsored by DOE
(UCRL-Trans-11554) Avail: NTIS HC A02/MF A01

A method for quantitative gas analysis of sulfur dioxide contained in nitrogen using the Fourier transform infrared spectrophotometer was established. On account of the strong adsorption properties of sulfur dioxide, the measuring method adopted was one in which the sample was made to flow inside the cell and in the sampling system. Measurements were conducted with a total pressure of 3 atm of the sample gas and with a spectrophotometer resolving power of 0.5/cm. This method has a range of application to sulfur dioxide concentrations ranging from 15% to 300 ppM, and the precision of analysis was 1.9%. DOE

N80-32469# General Atomic Co., San Diego, Calif.
THERMOCHEMICAL WATER-SPLITTING CYCLE, BENCH-SCALE INVESTIGATIONS AND PROCESS ENGINEERING Annual Report, 1 Oct. 1978 - 30 Sep. 1979
G. Caprioglio, K. H. McCorkle, G. E. Besenbruch, and J. S. Rode Mar. 1980 142 p ref
(Contract DE-AT03-76SF-90351; GA Proj. 3260)
(GA-A-15788) Avail: NTIS HC A07/MF A01

Process development work on the sulfur iodine thermochemical water splitting cycle is summarized. The work consisted of laboratory bench scale investigations, demonstration of the process in a closed loop cycle demonstrator, and process engineering design studies. A bench scale system, consisting of three subunits, was designed to study the cycle under continuous flow conditions. Progress on the installation and operation of subunits 1 and 2 is described. A closed loop cycle demonstrator was installed and operated. Operation of the sulfur iodine cycle was demonstrated in this system under recycle conditions. The process engineering addresses the flowsheet design of a large scale production process consisting of four chemical sections and one helium heat supply section. The completed designs for these sections are presented. The thermal efficiency of the process calculated from the present flowsheet is 47%. DOE

N80-32470# University of Western Michigan, Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Dec. 1978 - 28 Mar. 1980
Thomas Houser and Michael E. McCarville Jun. 1980 10 p refs
(Contracts DE-AC01-76ET-10593; EX-76-C-01-2018)
(FE-2018-16) Avail: NTIS HC A02/MF A01

It was assumed that a fraction (alpha) of decomposed pyridine formed an intermediate, a fraction of which (beta) was capable of reacting further to form HCN, and that formation was first order in intermediate. The following rate equation describes the data: rho/t = k/sub b/ alpa beta-k/sub b/rho. Rho is moles HCN formed/mole pyridine decomposed, t is contact time and k/sub b/ is the first order rate constant for the formation step. Since rho was independent of initial pyridine concentration, the formation step was necessarily first order. The fraction of decomposed pyridine which can form HCN at a given time ranged from 0.16 to 0.77, indicating a significant concentration of intermediate builds up at all conditions. No volatile product found in the pyrolysis is close to that range of yields, thus the precursor to the HCN must react further on leaving the reactor. DOE

N80-32471# University of Western Michigan, Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Sep. - 28 Dec. 1979
Thomas Houser Jun. 1980 12 p refs
(Contracts DE-AC01-76ET-10593)
(FE-2018-15) Avail: NTIS HC A02/MF A01

A rate equation for the oxidation of pyridine in the temperature range of 948 to 1048 K and for both fuel lean and rich mixtures was developed. The rate is first order in oxygen and half order each in pyridine and oxygen consumed, indicating catalysis by product(s). Measurements of the products indicated, at all temperatures from 948 to 1273 K, that HCN was the major volatile product containing nitrogen for fuel rich mixtures. Only at 1273 K were there large amounts of NO produced from fuel lean mixtures. At 1173 K and below only very small yields of NO, about 1% or less, were found. The papers on pyridine pyrolysis kinetics were revised and resubmitted. DOE

N80-32472# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
METHANOL AND METHYL FUEL CATALYST Progress Report, Sep. 1978 - Nov. 1979
Kamil Klier and Richard G. Herman Dec. 1979 9 p refs
(Contracts DE-AS01-78ET-10741; ET-78-S-01-3177)
(FE-3177-5) Avail: NTIS HC A02/MF A01

Results of diffuse reflectance studies and quantitative X-ray powder diffraction measurements supported the proposal that Cu(+)/ZnO solid solution is the catalytically important moiety in low pressure methanol synthesis catalysts. A decrease in CO2 concentration led to a decrease in carbon conversion to methanol over Ak based Cu/ZnO catalysts. This difference in kinetic behavior showed a remarkable influence of the support on the course of the synthesis. The dependence of reaction rates on CO2 concentration was actively investigated for these catalysts and for La based ternary catalysts, as well as for binary and ternary catalysts doped with alkali metal ions such as Rb(+). Although the effects on the methanol synthesis kinetics in the presence of CO2 were very marked, oxides did not appear to change the composition of the product and all catalysts investigated here are still highly selective to methanol. DOE

N80-32473# Johns Hopkins Univ., Baltimore, Md. Chemical Engineering Dept.
CONDENSATION PROCESSES IN COAL COMBUSTION PRODUCTS Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Joseph L. Katz and Marc D. Donohue Apr. 1980 12 p ref
(Contract DE-AS02-79ER-10456; ER-78-S-02-4947)
(DOE/ER-10456/1) Avail: NTIS HC A02/MF A01

Slag vaporization is a serious problem in high temperature coal combustion and gasification processes. Cooling of process gas streams causes the slag vapors to condense, but they do not necessarily do so at equilibrium. Predicting the compositions and properties of the condensing species requires modeling the nucleation processes occurring in these systems. Progress toward modeling this nucleation process and toward implementing the model with a computer code suitable for design calculations is reported. DOE

N80-32474# Michigan Technological Univ., Houghton.
COAL COMBUSTION BY WET OXIDATION. WET OXIDATION OF COAL FOR ENERGY PRODUCTION: TEST PLAN AND PARTIAL RESULTS Interim Report
Jeffrie A. Bettinger 10 Jul. 1980 58 p refs
(Contract DE-FG01-78ET-12328)
(DOE/ET-12328/T1) Avail: NTIS HC A04/MF A01

A steam generating facility, employing the wet oxidation of coal as a heat source was studied. The higher the reaction temperature, the more complete is the combustion of coal. Operation at elevated temperatures and pressures present difficult design problems, and the necessary equipment is costly. With a reduction in temperature from 228 C to 232 C, the operating pressure is reduced by more than half, thus holding down the overall cost of the system. Both the enhancement of low temperature wet oxidation of coal, and the higher operating regions were studied. The coal selected for the first portion of this test is an Eastern Appalachian high-volatile-A Bituminous type, from the Upper Clarion seam in Pennsylvania. This coal was selected as being a typical high sulfur, eastern coal. The wet oxidation of coal to produce low pressure steam is a process suited for a high sulfur, low grade, coal. DOE

N80-32475# University of Western Michigan, Kalamazoo. Dept. of Chemistry.

FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Jun. - 28 Sep. 1979

Thomas Houser DOE May 1980 12 p
(Contracts EX-76-C-01-2018; DE-AC01-76ET-10593)
(FE-2018-14) Avail: NTIS HC A02/MF A01

The rate of oxidation of pyridine was determined over a wide range of conditions: temperature range of 675 to 775 C; concentration 0.25 to 2.0 mole percent pyridine; and 1 to 7 mole percent oxygen. In addition, the oxidation of HCN was examined to determine the extent of NO formation. DOE

N80-32476# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF HIGH TEMPERATURE VISCOSITY MEASUREMENT TECHNIQUE

R. P. Wemple, W. F. Hammetter, and C. J. Greenhold Apr. 1980 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0641) Avail: NTIS HC A03/MF A01

The conception, development, and testing of: (1) an electromagnetic viscometer and (2) an X-ray technique are reported. Both methods employ a falling metallic sphere in the melt and provide real-time data. Initial testing of the electromagnetic viscometer was performed at one bar and from 700 to 1300 C. Follow-on experiments with this viscometer were carried out at 1 bar and 0.466 Kbar (6.8 Kpsi) argon up to 1250 C at the Sandia Magma Energy Research Test Facility. The X-ray method was tested entirely at one bar and up to 1325 C. A simultaneous test series with both methods was performed at one bar. Various calibration glasses and basalts were used to evaluate the methods. Correlation of the two methods with each other and with reference data was within acceptable limits. DOE

N80-32477# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF COHERENT AND SPONTANEOUS RAMAN COMBUSTION DIAGNOSTICS

L. A. Rahn, P. L. Mattern, and R. L. Farrow Jun. 1980 29 p refs Presented at 18th Intern. Symp. on Combust.
(Contract DE-AC04-76DP-00789)
(SAND-80-8616) Avail: NTIS HC A03/MF A01

Detectivities are calculated for background substraction coherent anti-Stokes Raman scattering (CARS), inverse Raman scattering (IRS) and spontaneous Raman scattering (RS) for a wide range of pressures and temperatures applicable to combustion environments. The capability of each of these techniques to reject the background luminosity typical of real combustion environments is established quantitatively. Examples of spectra from CARS and IRS flame experiments are shown, and the complementary features of these techniques are discussed. DOE

N80-32478# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
CHARACTERISTIC PARAMETERS IN COMBUSTION PROCESSES AND THEIR ACCESSIBILITY TO CURRENT AND FUTURE DIAGNOSTICS Annual Report, 1 Jun. 1979 - 31 May 1980

R. Goulard 1 May 1980 21 p refs
(Contracts ER-78-S-05-5773; DE-AS05-78ER-05773)
(DOE/ER-05773/2) Avail: NTIS HC A02/MF A01

The advances in the fluid dynamics of jet mixing are discussed, with an emphasis on the 10 kHz range (especially vortex shedding). Also the very fast subnanosecond range of radical kinetics is investigated, as well as the comparably fast scattering and fluorescence processes. High speed diagnostics are discussed in these two ranges of time resolution, with an emphasis on optical tomography for the fluid dynamic time range 10 to the minus 4th power and on picosecond techniques for the physical chemistry range 10 to the minus 9th power. DOE

N80-32479# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF CARS AND LASER-INDUCED SATURATED FLUORESCENCE FOR PRACTICAL COMBUSTION DIAGNOSIS Final Report, Aug. 1978 - Aug. 1979

A. C. Eckbreth, P. A. Bonczyk, and J. F. Verdieck May 1980 105 p refs
(Contract EPA-68-02-3105)
(PB80-190515; EPA-600/7-80-091) Avail: NTIS HC A06/MF A01 CSCL 07D

Results of experimental investigations aimed at developing nonperturbing, spatially precise, in situ diagnostic techniques to measure species composition and temperature in flame are given. The practical feasibility of coherent antistokes roman spectroscopy (CARS) was demonstrated in a program of researchscale combustor testing (results agreed to within 5% for combustion zone temperature measurements made with CARS and with shielded thermocouples). Laser induced saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was obtained. Promising initial results of NO fluorescence in flames are described. GRA

N80-32480# National Inst. for Occupational Safety and Health, Cincinnati, Ohio. Measurements Research Branch.
DIETHYLCARBAMOYL CHLORIDE - MEASUREMENTS RESEARCH BRANCH, ANALYTICAL METHOD

Jan. 1980 11 p ref
(PB80-193378) Avail: NTIS HC A02/MF A01 CSCL 07D

A known amount of air was drawn through a sorbent tube containing Porapak P to trap the analyte present. The Porapak P was transferred to a small stoppered sample container and the analyte was desorbed with ethyl acetate. An aliquot of the resulting solution was injected into a gas chromatograph equipped with a flame ionization detector. The area of the resulting peak was determined and compared with areas obtained from the injection of standards. GRA

N80-32481# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
ANALYSIS OF LIQUID VOLUME AND LIQUID MASS FRACTIONS AT COEXISTENCE FOR PURE FLUIDS

Lambert John VanPoolen May 1980 64 p refs
(PB80-191133; NBSIR-80-1631) Avail: NTIS HC A04/MF A01 CSCL 07D

An analysis of the behavior of liquid volume and liquid mass fractions at coexistence for pure fluids is made. Scaled equations for the saturation liquid and vapor densities are analyzed and relationships between various exponents and among constant coefficients are presented. Inequalities which exist among the saturation densities and their derivatives are developed. A procedure to correlate saturation data with the critical point is applied to ethylene. An experimental procedure to determine, simultaneously, saturated liquid and vapor densities at a given temeprature are presented. GRA

N80-32482# California Univ., Davis. Water Resources Center.
MULTIELEMENT ANALYSIS OF WATER THROUGH OSMOTIC REDUCTION AND X-RAYS Technical Completion Report

Thomas A. Cahill, Danny J. Shadoan, and Chris. C. Couper May 1980 .15 p refs
(PB80-216690; W80-05403; OWRT-A-069-CAL-1) Avail: NTIS HC A02/MF A01 CSCL 07D

A reverse osmosis or vapor filtration system was designed, built, and tested for reduction of water samples into particulate and solute fractions. The samples were reduced to 14cm2 circles of deposit on Nuclepore and cellophane substrates with little loss of material, suitable for direct introduction into X-ray analysis systems (X-ray fluorescence and/or particle induced X-ray emission). Sensitivities achieved depend on total mass loading in each phase, but ppb levels of transition metals in drinking water can be accomplished. Light element sensitivities are poorer due to chlorine interference in the cellophane. GRA

N80-32483# JRB Associates, McLean, Va.
MATERIALS BALANCE FOR BENZENE. LEVEL 1: PRELIMINARY Final Report

Robert L. Hall, Carlos Buitrago, Frank Monteoalvo, Tom Yatsko, and Karen Slimak 9 May 1980 161 p refs

(Contract EPA-68-01-5793)
(PB80-185663; Rept-2-800-03-379-51; EPA-560/13-80-014) Avail: NTIS HC A08/MF A01 CSCL 07A

A level I materials balance was performed on benzene. Data for benzene production from petroleum by four processes (catalytic reformation, toluene dealkylation, toluene disproportionation, and isolation from pyrolysis gasoline) and for production from coal during coking are presented. Amounts of benzene consumed for the synthesis of nine direct derivatives and exports are presented. These uses constitute approximately 93 percent of total benzene usage. Nonconsumptive uses (solvents and inventory changes) were also tabulated. Emissions due to each of the above processes are reported or estimated where possible. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-32484* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent

Joseph R. Stephens and Walter R. Witzke, inventors (to NASA) Issued 29 Jul. 1980 4 p Filed 25 Jan. 1979 Supersedes N79-19145 (17 - 10, p 1255) Continuation-in-part of abandoned US Patent Appl. SN-803822, filed 6 Jun. 1977
(NASA-Case-LEW-12542-3; US-Patent-4,214,902; US-Patent-Appl-SN-007083; US-Patent-Class-75-124; US-Patent-Appl-SN-803822) Avail: US Patent and Trademark Office CSCL 11F

An iron alloy is provided which exhibits strength and toughness characteristics at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, about 0.1 to 1.0 percent by weight aluminum, and 0 to about 3 percent by weight copper, with the balance being essentially iron. The iron alloy is produced by a process which includes cold rolling at room temperature and subsequent heat treatment. Official Gazette of the U.S. Patent and Trademark Office

N80-32485# National Academy of Sciences - National Research Council, Washington, D. C.

MATERIALS RESPONSE TO ULTRA-HIGH LOADING RATES Final Report

1980 152 p refs
(Contract MDA903-78-C-0038)
(NMAB-356) Avail: NTIS HC A08/MF A01

The equations of state, plastic yielding, empirical failure models, brittle crack propagation, ductile void growth, and adiabatic shear banding are individually examined. Current descriptions are examined in the light of the present understanding of deformation and failure mechanisms, in order to identify shortcomings and make recommendations for alleviating them. Existing deformation descriptions are found adequate for most present applications, but more effort is needed to obtain relevant dynamic material properties on the other hand, the description of dynamic material failure is in its infancy, and effort is required to advance both theory and experiment. M.G.

N80-32486*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRACTURE TOUGHNESS OF BRITTLE MATERIALS DETERMINED WITH CHEVRON NOTCH SPECIMENS

J. L. Shannon, Jr., R. T. Bursey, D. Munz (Karlsruhe Univ.), and W. S. Pierce [1980] 17 p refs Proposed for presentation at the 5th Intern. Conf. on Fracture, Cannes, France, 29 Mar. - 3 Apr. 1981; sponsored by the International Congress on Fracture
(NASA-TM-81607; E-600) Avail: NTIS HC A02/MF A01 CSCL 11F

The use of chevron-notch specimens for determining the plane strain fracture toughness (K sub ic) of brittle materials is discussed. Three chevron-notch specimens were investigated: short bar, short rod, and four-point-bend. The dimensionless stress intensity coefficient used in computing K sub Ic is derived for the short bar specimen from the superposition of ligament-dependent and ligament-independent solutions for the straight through crack, and also from experimental compliance calibrations. Coefficients for the four-point-bend specimen were developed by the same superposition procedure, and with additional refinement using the slice model of Bluhm. Short rod specimen stress intensity coefficients were determined only by experimental compliance calibration. Performance of the three chevron-notch specimens and their stress intensity factor relations were evaluated by tests on hot-pressed silicon nitride and sintered aluminum oxide. Results obtained with the short bar and the four-point-bend specimens on silicon nitride are in good agreement and relatively free of specimen geometry and size effects within the range investigated. Results on aluminum oxide were affected by specimen size and chevron-notch geometry, believed due to a rising crack growth resistance curve for the material. Only the results for the short bar specimen are presented in detail. M.G.

N80-32487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF TWO-LAYER THERMAL BARRIER SYSTEMS ON DIRECTIONALLY SOLIDIFIED Ni-Al-Mo AND COMPARATIVE EFFECTS OF ALLOY THERMAL EXPANSION ON SYSTEM LIFE

Stephan Stecura Washington Oct. 1980 35 p refs
(NASA-TM-81604; E-453) Avail: NTIS HC A03/MF A01 CSCL 11F

A promising two-layer thermal barrier coating system (TBS), Ni-16.4Cr-5.1Al-0.15Y/ZrO2-6.1Y2O3 (all in weight percent), was identified for directionally solidified Ni-Al-Mo (gamma/gamma' alpha). In cyclic furnace tests at 1095 C this system on gamma/gamma' alpha was better than Ni-16. 4Cr-5.1Al-0. 15Y/ZrO2-7.8Y2O3 by about 50 percent. In natural gas - oxygen torch rig tests at 1250 C the ZrO2-6.1Y2O3 coating was better than the ZrO2-7.8Y2O3 coating by 95 percent, on MAR-M509 substrates and by 60 percent on gamma/gamma' alpha substrates. Decreasing the coefficient of thermal expansion of the substrate material from 17-18x10 to the -6 power/C (MAR-M200 + Hf and MAR-M509) to 11x10 to the -6 power/C (gamma/gamma' alpha) also resulted in improved TBS life. For example, in natural gas - oxygen torch rig tests at 1250 C, the life of Ni-16.4Cr-5.1Al-0.15Y/ZrO26.1Y2O3 was about 30 percent better on gamma/gamma' alpha than on MAR-M509 substrates. Thus compositional changes in the bond and thermal barrier coatings were shown to have a greater effect on TBS life than does the coefficient of thermal expansion. Author

N80-32488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP-RUPTURE BEHAVIOR OF SEVEN IRON-BASE ALLOYS AFTER LONG TERM AGING AT 760 DEG IN LOW PRESSURE HYDROGEN Final Report

Walter R. Witzke and Joseph R. Stephens Aug. 1980 40 p refs
(Contract EC-77-A-31-1040)
(NASA-TM-81534; DOE/NASA/1040-15; E-486) Avail: NTIS HC A03/MF A01 CSCL 11F

Seven candidate iron-base alloys for heater tube application in the Stirling automotive engine were aged for 3500 hours at 760 C in argon and hydrogen. Aging degraded the tensile and creep-rupture properties. The presence of hydrogen during aging caused additional degradiation of the rupture strength in fine grain alloys. Based on current design criteria for the Mod 1 Stirling engine, N-155 and 19-9DL are considered the only alloys in this study with stregnths adequate for heater tube service at 760 C Author

N80-32489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LONG-TIME CREEP BEHAVIOR OF THE TANTALUM ALLOY ASTAR 811C

William D. Klopp, Robert H. Titran, and Keith D. Sheffler (Pratt and Whitney Aircraft, East Hartford, Conn.) Sep. 1980 21 p refs
(NASA-TP-1691; E-041) Avail: NTIS CSCL 11F

The high vacuum creep behavior of Astar 811C (Ta-8W-1Re-o. 7Hf-0.025C) was studied over the temperature range 800 C to 1700 C as a function of stress, temperature, and grain size in order to develop a relation for predicting long term creep. Primary

creep strain was related to time by the Garofalo exponential function, and a second exponential term was developed to describe the tertiary creep portion of the creep curve. No significant periods of secondary (linear) creep were observed. The creep curves were well expressed by a relation that includes terms for primary and tertiary creep. The initial and tertiary creep rates were obtained by differentiating the respective terms from the strain time relation and can be related to temperature by using a dual activation energy to account for lattice and dislocation core diffusion. The strain parameters were determined as power functions of the applied stress. A.R.H.

N80-32490*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-TEMPERATURE SOLDER FOR JOINING LARGE CRYOGENIC STRUCTURES
John D. Buckley and Paul G. Sandefur, Jr. Washington Sep. 1980 15 p refs
(NASA-TM-81836; L-13712) Avail: NTIS HC A02/MF A01 CSCL 11F

Three joining methods were considered for use in fabricating cooling coils for the National Transonic Facility. After analysis and preliminary testing, soldering was chosen as the cooling coil joining technique over mechanical force fit and brazing techniques. Charpy V-Notch tests, cyclic thermal tests (ambient to 77.8 K) and tensile tests at cryogenic temperatures were performed on solder joints to evaluate their structural integrity. It was determined that low temperature solder can be used to ensure good fin-to-tube contact for cooling-coil applications. Author

N80-32491# Minnesota Univ., Minneapolis. Dept. of Chemistry.
VIBRATIONAL FREQUENCIES OF HALOGEN ATOMS ADSORBED ON SILVER METAL SURFACES
Henry Nichols and Robert M. Hexter 17 Jul. 1980 24 p refs Submitted for publication
(Contract N00014-77-C-0209; NR Proj. 051-642)
(AD-A087664; TR-5) Avail: NTIS HC A02/MF A01 CSCL 11/6

The vibrational frequencies of halogens adsorbed on Ag 100 are calculated. The frequency of a single adsorbed atom vibration perpendicular to the surface is obtained from AgX (X = F, Cl, Br, I) crystal frequencies. Interaction between dipoles consisting of the effective charge on the absorbed atom and its induced image charge produces a coverage dependent frequency. The effective charge on the adsorbed atom is assumed to be 1.0 e, while the electronic polarizability of the real-plus-image atom system is assumed to be twice the electronic polarizability of x(-). At full coverage, the calculated frequencies for the k = 0 modes are 437, 241, 150, and 113/cm respectively for X = F, Cl, Br, and I, which compare well with experimental values, and these frequencies are assigned to external vibrational modes of halogen atoms adsorbed on silver. M.G.

N80-32492# Oxford Univ. (England). Dept. of Theoretical Chemistry.
INTERATOMIC FORCES IN SOLID AND LIQUID TRANSITION METALS Final Technical Report, Apr. 1978 - Mar. 1980
N. H. March and C. C. Matthai Jan. 1980 93 p refs
(Grant DA-ERO-78-G-052; DA Proj. 1T1-61102-BH-57)
(AD-A087672) Avail: NTIS HC A05/MF A01 CSCL 07/2

The objective was to obtain a practical description of the force fields in transition metals. Central pair potentials for Ni and Pt have been constructed in agreement with calculations and experiments. The obtained representation of the force field is very useful for f.c.c. solid transition metals. X-ray scattering factors showed that charge distribution in b.c.c. transition metals is highly angular. Bond charge model has been used to represent this angularity. GRA

N80-32493# Naval Research Lab., Washington, D. C.
NEUTRON IRRADIATION EFFECTS ON FATIGUE CRACK PROPAGATION IN TYPE 316 STAINLESS STEELS AT 649 DEG C
D. J. Michel and H. H. Smith 1 Aug. 1980 20 p refs
(Contract DE-AI05-80OR-20352)
(AD-A088052; NRL-MR-4282) Avail: NTIS HC A02/MF A01 CSCL 11/6

The fatigue and creep fatigue crack propagation performance of Type 316 stainless steel was investigated following fast neutron irradiation to a fluence level of about 5 x 10 to the 22nd power n/sq. cm (~ 0.1 MeV), about 26 displacements per atom (dpa), at 649 C. The results from fatigue tests of both annealed and 20 percent cold worked steel show that irradiation produced no significant effect on crack propagation rate when compared with unirradiated steel tested at 649 C. For tests conducted using creep fatigue cycling, the inclusion of a two minute hold time at the maximum cyclic load resulted in a marked increase in the crack propagation rate of the annealed steel. The effect of a one minute hold time in the 20 percent cold worked, irradiated steel was to significantly increase the crack propagation rate at 649 C. Scanning electron microscope examination of the tested specimens revealed that the crack propagation mode of the specimens which exhibited increased crack propagation rates was primarily intergranular while a transgranular mode was observed for specimens with lower crack propagation rates. The results point toward a synergistic relationship between thermochemical history, precipitate formation, and hold time effects as the responsible mechanism for the crack propagation performance. GRA

N80-32494# SRI International Corp., Menlo Park, Calif.
DIP PROCESS THERMAL BARRIER COATINGS FOR SUPERALLOYS Final Report, 1 Jul. 1979 - 30 Jun. 1980
I. M. Allam, R. W. Bartlett, and G. N. Krishnan Jun. 1980 38 p refs
(Contract F49620-79-C-0225; AF Proj. 2306; SRI Proj. PYU-8658)
(AD-A088064; AFOSR-80-0572TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

A new technique of developing thermal barrier coatings for superalloys has been investigated. It involves hot dipping of superalloys samples into a molten bath of low melting Ce-Co or Ce-Ni alloy. By internally oxidizing these coatings, it is possible to obtain a duplex with a CeO2 rich oxide scale as the outer layer (thermal barrier) and an inner layer composite of fine cerium oxide particles dispersed in a matrix of Ni(Co)CrAl. This inner layer, or subscale, grades into the superalloy. Appropriate heat treatment can produce recrystallized CeO2 particles in the subscale that should improve adherence of the oxide scale to the subscale and substrate superalloy. The coating process does involve limited reaction between the coating alloy and superalloy. The thickness of this interaction zone can be controlled and compensated for in the design (cross section) of the superalloy component. GRA

N80-32495# Solar Turbines International, San Diego, Calif.
ISOTHERMAL ROLL FORGING OF T55 COMPRESSOR BLADES, PHASE 2 Final Report, Feb. 1978 - Jan. 1980
Fred K. Rose and Arthur G. Metcalfe Jun. 1980 118 p
(Contract DAAG46-76-C-0043)
(AD-A088076; SR80-R-4392-43;
USAAVRADCOM-TR-80-F12; AMMRC-TR-80-32) Avail: NTIS HC A06/MF A01 CSCL 13/8

The objective of Phase 2 of this manufacturing technology program was to produce the 2nd stage blade of the Avco T-55 engine for static evaluation using the isothermal roll forge process. Blades were produced in AM-350 alloy using two roll forge passes of the energy efficient, microprocessor controlled process. The blades met the fatigue, tensile and metallurgical requirements of Avco specifications. GRA

N80-32496# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
FUNDAMENTALS OF CORROSION FATIGUE BEHAVIOR OF METALS AND ALLOYS
David J. Duquette Aug. 1980 33 p refs
(Contract N00014-75-C-0466)
(AD-A088358) Avail: NTIS HC A03/MF A01 CSCL 11/6

It is well known that environment plays a very important role in fatigue failures. In some cases only crack propagation rates are affected; however, for many others all of the steps leading to failure, pre initiation deformation, crack initiation and crack propagation are affected. For still other cases, only the crack initiation and early propagation processes are affected. This

paper attempts to evaluate the mechanisms which have been proposed for environmental effects on the early stages of fatigue damage, including crack initiation and early propagation in gaseous and in aqueous environments. Evidence is presented which indicates that there is no unifying theory of environmental fatigue, but that each alloy/environment couple may exhibit significantly different behavior, depending on factors such as thermodynamics and kinetics as well as microstructure, slip character, etc. GRA

N80-32497# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

THE AUSTENITIZING BEHAVIOR OF A LOW ALLOY STEEL

Peter A. Thornton May 1980 34 p refs

(AD-A088540; AD-E440079; ARLCB-TR-80013) Avail: NTIS HC A03/MF A01 CSCL 11/6

The austenitizing behavior of a low alloy steel was examined from both the microstructural and the mechanical property standpoint. The temperature range over which austenitizing took place was accurately determined by metallographic and analytical techniques. Metallographic evidence showed that the dissolution of carbide continues after the crystallographic transition is completed. Also, the dissolution of the preponderance of carbide coincides with a 'leveling-off' trend in mechanical property response, viz., yield strength and Charpy impact toughness. The data demonstrated that a minimum temperature of 774 C (1425 F) can sufficiently austenitize this steel under the appropriate conditions. However, because of chemical segregation invariably found in large forgings, it is a sound practice to allow some contingency in the heat treatment parameters that will consistently provide an adequate austenitizing condition in the thickest sections of a component. GRA

N80-32498# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon System Lab.

ELECTRODEPOSITION OF TANTALUM AND TANTALUM-CHROMIUM ALLOYS

I. Ahmad, W. A. Spiak, and G. J. Janz May 1980 37 p refs Presented at Ann. Meeting of AIME, Las Vegas, Nev., 24-28 Feb. 1980

(AD-A088542; AD-E440082; ARLCB-TR-80014) Avail: NTIS HC A03/MF A01 CSCL 13/8

A part of a program to develop erosion resistant coatings for advanced gun barrels, electrodeposition of tantalum and tantalum chromium alloys from fused FLINAK (eutectic mixture of LiF-KF-NaF) has been investigated. Tantalum chromium alloys containing 2-6% chromium were obtained by codepositing tantalum and chromium from an electrolyte containing 10 wt% TaF5(added as K2TaF7) and 0.5-1.5% Cr (added as CrF3), at 800 C and 15-40 ma/sq cm current density. The alloy coatings were smooth and columnar in structure. The microhardness of these coatings increased with the increase of chromium content. GRA

N80-32499# Naval Surface Weapons Center, Dahlgren, Va. Gun Systems and Munitions Div.

SHOCK COMPRESSION OF TANTALUM Final Report

Willis Mock, Jr. and William H. Holt Jun. 1980 26 p refs (NSWC MIPR A35200-9-0004)

(AD-A088152; NSWC/TR-80-92) Avail: NTIS HC A03/MF A01 CSCL 11/6

The free-surface velocity of a shock-loaded 3.73 mm thick tantalum disk has been measured with a capacitor gauge. Stress reverberations were produced in the tantalum disk by impacting it with a 2.65 mm thick alpha titanium disk at a velocity of 0.111 km/s in a gas gun. An initial shock compressive stress slightly larger than the measured 2.1 GPa Hugoniot elastic limit was produced in the tantalum. The shape of the free-surface-velocity profile suggested that spall fracture did not occur in the specimen disk at this stress level. This result was verified by examining the recovered and sectioned disk. GRA

N80-32500# Cornell Univ., Ithaca, N. Y.

INITIAL STAGES OF OXIDATION OF METALS AND ALLOYS Progress Report, 1 Aug. 1979 - 30 Apr. 1980

J. M. Blakely Apr. 1980 18 p

(Contract DE-AC02-79ER-10501)

(DOE/ER-10501/1) Avail: NTIS HC A02/MF A01

Investigations of metal surface oxidation are reported. Be and Fe-Ni single crystal surfaces were studied using the techniques of Auger and electron loss spectroscopy and low energy electron diffraction. A detailed study of the Auger line shape from clean cleaved Be (0001) planes has provided a standard against which all previous work may be composed. Progress has been made in preparing clean Be surfaces by ion sputtering techniques, computer processing of Auger data and some preliminary LEED studies have been made both of clean and oxygen covered surfaces. A liquid nitrogen cold stage for ribbon type single crystal samples has been constructed. The composition of the (100) surface of a Ni-60, Fe-40 single crystal has been investigated over the temperature range from 25 to 900 C. Under uhv conditions, only very slight enrichment in Fe occurs. Preliminary studies have also been made of surface structure and of C and S segregation to this Fe-Ni(100) surface. DOE

N80-32501# Sandia Labs., Livermore, Calif.

DESIGN AND OPERATION OF THERMAL CONVECTION LOOPS FOR CORROSION TESTING IN MOLTEN NaNO3-KNO3

W. S. Winters, R. W. Bradshaw, and F. W. Hart Jun. 1980 28 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-8212) Avail: NTIS HC A03/MF A01

The design, construction, operation, and preliminary results of three molten draw salt corrosion loop experiments are discussed. The loops were constructed from 304 SS, 316 SS, and Incoloy 800. Results indicate that convective loop experiments are a valuable and relatively inexpensive method of assessing the effects of mass transport and a fully operational temperature gradient on molten salt materials compatibility. DOE

N80-32502# Los Alamos Scientific Lab., N. Mex.

COMPARISON OF FLOW CURVES OF 6061 ALUMINUM ALLOY AT HIGH AND LOW STRAIN RATES

A. E. Carden, P. E. Williams, and R. R. Karpp 1980 15 p refs Presented at the Intern. Conf. on the Met. Effects of High Strain Rate Deformation and Fabric., Albuquerque, N. Mex., 22 Jun. 1980

(Contract W-7405-eng-36)

(LA-UR-80-1649; CONF-80061-5) Avail: NTIS HC A02/MF A01

Low strain rate tensile test data (10 to the -5 power to 10 to the -2 power/s) were obtained for 6061 aluminum alloy in the -T6- and -0- condition. Little, if any, strain rate effect was observed over this range of strain rates. Thirteen expanding ring tests were performed on 1 in. and 2 in. diam 6061-T6 and -0- temper rings with maximum strain rates of 3000 to 23,000/s. The flow stress at 2% circumferential exexpansion was determined from all of the tests and is shown to be dependent upon maximum strain rate. Furthermore, a size effect is observed, since flow stress at 2% strain and equal strain rates is greater in 2 in. rings than in 1 in. rings. This size effect may be due to shock hardening, but a definite conclusion has not yet been reached. The -T6- temper rings also show a size effect, but the difference between the 1 and 2 in. rings was not the same for all values of flow stress. DOE

N80-32503# Mound Lab., Miamisburg, Ohio.

THERMAL CONDUCTIVITY OF CONSOLIDATED Al/Cu2O THERMITES

Gary D. Miller and Lowell D. Haws 17 Jun. 1980 17 p refs

(Contract DE-AC04-76DP-00053)

(MLM-2698) Avail: NTIS HC A02/MF A01

Techniques for the measurement of the thermal conductivity, lambda, of Al/Cu2O consolidated thermites are addressed. Two methods, laser flash and comparative, were evaluated. The comparative method was found to be the method of choice. Results of the lambda measurements are reported as functions of temperature, part density, and aluminum particle shape. DOE

N80-32504# United Technologies Corp., South Windsor, Conn. Power Systems Div.

PARAMETER MONITORING FOR CORROSION CONTROL OF UTILITY GAS TURBINES Annual Report

Mar. 1980 104 p refs
(EPRI Proj. 643-1)
(EPRI-AP-1369) Avail: NTIS HC A06/MF A01

The conditions that cause deposition of corrodents and an engine control system that will minimize their effect are discussed. Field data on 600 engines were statistically analyzed to determine the influence on hot corrosion of: fuel type; engine washing; air filtration; and proximity of the engine sites to oceans. Laboratory tests were conducted to determine the effect of: sodium sulfate with and without impurities; temperature cycling; and sodium in the fuel. Sodium ion concentrations in the air stream inside engines were monitored for evidence of impulsive shedding of accumulated salt. Results show that intermittent water washing reduces the incidence of corrosion. An engine control system which monitors the atmospheric and fuel-borne salt concentrations and signals the need for an engine water wash cycle to remove accumulated salt before corrosion commences was designed, built, installed, and checked out. This unit can also reduce power, therefore temperature, to slow the corrosion rate if the wash is not performed. DOE

N80-32506# California Univ., Livermore. Lawrence Livermore Lab.

RF MAGNETRON SPUTTERING OF THICK PLATINUM COATINGS ON GLASS MICROSPHERES

S. F. Meyer, E. J. Hsieh, and R. J. Burt 28 May 1980 14 p refs Presented at the Intern. Conf. on Met. Coatings, San Francisco, 21 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-83532; CONF-800439-9) Avail: NTIS HC A02/MF A01

Coating problems encountered included a rough surface and porous microstructure from the oblique incidence and lack of temperature and bias control, clumping of the microspheres causing nonuniformities, and particle accumulation causing cone defects. Sputtering parameters significantly affecting the coatings included total pressure, DC substrate bias, and the addition of doping gases. Using an ultrasonic vibrating screened cage and RF magnetron Sputtergun, microspheres were batch coated. DOE

N80-32508# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.

APPLICATION OF ANALYTICAL ELECTRON MICROSCOPY TO THE STUDY OF INTERGRANULAR CORROSION IN 304 STAINLESS STEEL

C. S. Pande and R. L. Sabatini 1980 9 p refs Presented at the Ann. Meeting of the EMSA and 15th MAS Conf., San Francisco, 4 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27344; CONF-800801-5) Avail: NTIS HC A02/MF A01

The technique of analytical electron microscopy in a scanning transmission electron microscope fitted with an energy dispersive X-ray spectrometer is used to measure the chromium depletion in sensitized 304 stainless steel along the grain boundaries. It is shown that such measurements could be misleading unless care is taken to properly choose the regions on the grain boundaries for such analysis. DOE

N80-32507# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.

FLUX PINNING IN BRONZE-PROCESSED Nb3Sn WIRES

M. Suenaga and D. O. Welch 1980 13 p refs Presented at the Intern. Cryog. Mater. Conf., Upton, N.Y., 28 May 1980
(Contract DE-AC02-76CH-00016)
(BNL-27964; CONF-800587-4) Avail: NTIS HC A02/MF A01

The scaling law derived by Kramer for magnetic flux pinning in high magnetic fields was examined for its applicability to the magnetic field dependence of critical-current densities in the bronze processed monofilamentary Nb3Sn wires. From this it was concluded that: (1) its prediction for the form of the dependence of critical current on magnetic field and grain size was found to be very good in most cases including wires with very small Nb3Sn grains. It was found very useful in comparison of J sub c for different wires and in extrapolating to obtain H sub c2 for these wires. (2) However, it could not account consistently for the anisotropy in critical current of a tape which was measured with H applied perpendicular and parallel to the tape face. (3) The values of Kappa sub 1 which were determined with the scaling law were too small by a factor of 2 to 3, and the trend in the variation with heat-treating time was opposite to that which is reasonably to be expected. DOE

N80-32508# Argonne National Lab., Ill. Materials Science Div.

CORROSION BEHAVIOR OF SEVERAL METALS IN ETHYLENE GLYCOL-BASE HEAT-TRANSFER FLUIDS UNDER CONDITIONS ENCOUNTERED IN SOLAR ENERGY SYSTEMS

G. J. Zeman Jan. 1980 53 p refs
(Contract W-31-109-eng-38)
(ANL-79-96) Avail: NTIS HC A04/MF A01

The corrosion behavior of aluminum, copper, and iron in inhibited ethylene glycol-ASTM corrosive water solutions was evaluated in a laboratory loop under isothermal and heat flux conditions for 1000 h at temperatures between 378 and 413 K, in static autoclave tests at 450 K for 500 h, and by potentiodynamic polarization measurements at temperatures between 298 and 348 K. The effect of time, temperature, and ethylene glycol concentration of the heat transfer fluid on the extent of inhibitor depletion was determined from analyses of the reserve alkalinity, pH, and inhibitor content of the solutions. The performance of an electrochemical sensor as a monitor of fluid quality was also evaluated. A heat flux of 0.4 to 1.0 kW cu m did not have a significant effect on the corrosion behavior of the various materials at temperatures between 378 and 413 K. The corrosion rates of aluminum, copper, and iron in the 50 volume percent inhibited ethylene glycol-corrosive water solution decreased as a function of time during the 1000 h test. At 413 K, the corrosion rate of copper was considerably higher than that of iron or aluminum at low flow velocity. DOE

N80-32509# General Electric Co., Schenectady, N. Y. Metallurgy Lab.

DEVELOPMENT OF A LOW LOSS MAGNETIC COMPOSITE UTILIZING AMORPHOUS METAL FLAKE Semiannual Progress Report, 19 Sep. 1978 - 18 Mar. 1979

Lyman A. Johnson Apr. 1979 68 p refs
(Contract ET-78-C-01-3205)
(CONS-3205-T1; SAPR-1) Avail: NTIS HC A04/MF A01

Progress is reported concerning processing amorphous metal flake by splat cooling and melt extracion, magnetic and physical properties assessment, and forming a composite of the metal flake and epoxy binders. DOE

N80-32510# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

STRUCTURE OF HIGH ANGLE GRAIN BOUNDARIES IN METALS AND CERAMIC OXIDES

R. W. Balluffi, P. D. Bristowe, and C. P. Sun Dec. 1979 70 p refs Presented at the Basic Sci. and Nuclear Div., Fall meeting of the ACS, New Orleans, 14-17 Oct. 1979
(Contract DE-AS02-78ER-05002; ER-78-S-02-5002)
(DOE/ER-05002/9; CONF-791045-8) Avail: NTIS HC A04/MF A01

The state of current knowledge of the structure of high angle grain boundaries in metals and in ceramic oxides is reviewed. Particular attention is given to effects due to differences in the bonding and crystal structure in these solid types. The results of recent experimental work and efforts to model grain boundary structure using computer simulation methods are described. Important characteristic features of boundaries in these materials are discussed. Difficulties which are presently being encountered in efforts to determine their structure are pointed out. DOE

N80-32511# Oak Ridge National Lab., Tenn.

MICROSTRUCTURE AND TENSILE PROPERTIES OF HEAVILY IRRADIATED 5052-0 ALUMINUM ALLOY

K. Farrell 1980 23 p refs
(Contract W-7405-eng-26)
(CONF-800609-3) Avail: NTIS HC A02/MF A01

During neutron irradiation of an aluminum 2.2% magnesium solid solution alloy in the High Flux Isotope Reactor about seven percent insoluble, transmutant silicon was produced. Some of

this silicon reacted with the dissolved magnesium to form a fine precipitate of Mg2Si. A tight dislocation structure was also created. The alloy showed good resistance to cavity formation. Tension tests at 323, 373, and 423 K (0.35, 0.40, and 0.45 T sub m) showed pronounced irradiation-induced strengthening and an associated marked loss in ductility. These changes were greater than in magnesium free aluminum and in alloys containing preexisting, thermally aged Mg2Si precipitate. Increasing the thermal to fast flux ratio from 1.7 to 2.1 caused further strengthening beyond that expected from a simple increase in silicon level. DOE

N80-32512# Hanford Engineering Development Lab., Richland, Wash.

WEAR AND CORROSION PERFORMANCE OF METALLURGICAL COATINGS IN SODIUM

R. N. Johnson and D. G. Farwick 24 Apr. 1980 18 p refs Presented at Intern. Conf. on Metallurgical Coatings, San Diego, Calif., 24 Apr. 1980

(Contract DE-AC14-76FF-02170)

(HEDL-SA-1979; CONF-800439-10) Avail: NTIS HC A02/MF A01

The friction, wear, and corrosion performance of several metallurgical coatings in 200 to 650 C sodium were reviewed. Emphasis was placed on those coatings which have successfully passed the qualification tests necessary for acceptance in breeder reactor environments. Tests included friction, wear, corrosion, thermal cycling, self-welding, and irradiation exposure under as prototypic as possible service conditions. Coatings of various refractory metal carbides in metallic binders, nickel-base and cobalt-base alloys and intermetallic compounds such as the aluminides and borides were tested. Coating processes evaluated included plasma spray, detonation gun, sputtering, spark-deposition, and solid-state diffusion. DOE

N80-32513# National Technical Information Service, Springfield, Va.

METAL MATRIX COMPOSITES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Jun. 1980

William E. Reed Jun. 1980 110 p Supersedes NTIS/PS-79/0681; NTIS/PS-78/0684

(PB80-811912; NTIS/PS-79/0681; NTIS/PS-78/0684) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Fabrication, casting, mechanical properties and testing of metal matrix composites including eutectic, particulate, and whisker composites are included in this report of Federally-funded research. Studies on reinforcing materials, fatigue, failure, and structure are also reported. Most of this research is applied to aircraft and spacecraft components and superconducting machinery. This updated bibliography contains 99 abstracts, 42 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-32514* National Aeronautics and Space Administration. Pasadena Office, Calif.

CURABLE LIQUID HYDROCARBON PREPOLYMERS CONTAINING HYDROXYL GROUPS AND PROCESS FOR PRODUCING SAME Patent

Robert A. Rhein (JPL) and John D. Ingham, inventors (to NASA) (JPL) Issued 3 Oct. 1980 6 p Filed 28 Jun. 1973 Continuation-in-part of abandoned US Patent Appl. SN-332123, filed 13 Feb. 1973 Sponsored by NASA

(NASA-Case-NPO-13137-1; US-Patent-4,118,427; US-Patent-Appl-SN-374810; US-Patent-Appl-SN-332123; US-Patent-Class-568-852; US-Patent-Class-568-861) Avail: US Patent and Trademark Office CSCL 07A

Production of hydroxyl containing curable liquid hydrocarbon prepolymers by ozonizing a high molecular weight saturated hydrocarbon polymer such as polyisobutylene or ethylene propylene rubber is discussed. The ozonized material is reduced using reducing agents, preferably diisobutyl aluminum hydride, to form the hydroxyl containing liquid prepolymers having a substantially lower molecular weight than the parent polymer. The resulting curable liquid hydroxyl containing prepolymers can be poured into a mold and readily cured, with reactants such as toluene diisocyanate, to produce highly stable elastomers having a variety of uses such as binders for solid propellants.

Official Gazette of the U.S. Patent and Trademark Office

N80-32515* National Aeronautics and Space Administration. Pasadena Office, Calif.

PREPOLYMER DIANHYDRIDES Patent

Robert A. Rhein (JPL) and John D. Ingham, inventors (to NASA) (JPL) Issued 1 Apr. 1980 6 p Filed 14 Aug. 1978 Continuation of abandoned US Patent Appl. SN-761252, filed 21 Jan. 1977 Sponsored by NASA

(NASA-Case-NPO-13899-1; US-Patent-4,196,129; US-Patent-Appl-SN-933186; US-Patent-Class-260-346.3; US-Patent-Appl-SN-761252) Avail: US Patent and Trademark Office CSCL 07A

A process for preparing dianhydrides that are miscible with hydroxyl prepolymers at moderate temperatures and can cure hydroxyl prepolymers to elastomers at moderate temperatures is disclosed. The dianhydrides are prepared by solution reaction of a prepolymer diol with excess hydride followed by removal of unreacted dianhydride. The prepolymer dianhydrides are miscible with hydroxyl substituted hydrocarbon prepolymers and cure the prepolymers to polyester-linked elastomers.

Official Gazette of the U.S. Patent and Trademark Office

N80-32516* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METHOD OF CROSS-LINKING POLYVINYL ALCOHOL AND OTHER WATER SOLUBLE RESINS Patent

Warren H. Phillipp, Charles E. May, Li-Chen Hsu, and Dean W. Sheibley, inventors (to NASA) Issued 19 Aug. 1980 4 p Filed 20 Dec. 1978 Supersedes N79-14172 (17 - 05, p 0571)

(NASA-Case-LEW-13103-1; US-Patent-4,218,280; US-Patent-Appl-SN-971596; US-Patent-Class-156-272; US-Patent-Class-156-292; US-Patent-Class-264-22; US-Patent-Class-264-212; US-Patent-Class-204-159.11; US-Patent-Class-204-159.14; US-Patent-Class-427-44; US-Patent-Class-428-500; US-Patent-Class-429-139) Avail: US Patent and Trademark Office CSCL 07C

A self supporting sheet structure comprising a water soluble, noncrosslinked polymer such as polyvinyl alcohol which is capable of being crosslinked by reaction with hydrogen atom radicals and hydroxyl molecule radicals is contacted with an aqueous solution having a pH of less than 8 and containing a dissolved salt in an amount sufficient to prevent substantial dissolution of the noncrosslinked polymer in the aqueous solution. The aqueous solution is then irradiated with ionizing radiation to form hydrogen atom radicals and hydroxyl molecule radicals and the irradiation is continued for a time sufficient to effect crosslinking of the water soluble polymer to produce a water insoluble polymer sheet structure. The method has particular application in the production of battery separators and electrode envelopes for alkaline batteries.

Official Gazette of the U.S. Patent and Trademark Office

N80-32517*# Massachusetts Inst. of Tech., Cambridge. School of Engineering.

TOUGHENING OF THERMOSETTING POLYIMIDES

David S. Gollob, John F. Mandell, and Frederick J. McGarry Aug. 1979 47 p refs Sponsored by NASA

(NASA-CR-163594; MIT-CE-R79-1) Avail: NTIS HC A03/MF A01 CSCL 07C

Work directed toward increasing the resistance to crack propagation of thermoset polyimides is described. Rubber modification and Teflon microfiber impregnation techniques for increasing fracture toughness are investigated. Unmodified Kerimid 601 has a fracture surface work value of 0.20 in-lbs/sq in. Dispersed particles of amine terminated butadiene acrylonitrile liquid rubber or of silicone rubber do not raise this value much. By contrast, 5 percent of well fibrillated Teflon produces an eight-fold increase in fracture toughness. Further process improvements should increase this factor to 20-30. M.G.

N80-32518# Pennsylvania Univ., Philadelphia.
MICROWAVE PROPERTIES OF LOW DENSITY (CH) SUB X Interim Technical Report
A. Feldblum, Y. W. Park, A. J. Heeger, A. G. MacDiarmid, G. Wnek, F. Karasz, and J. C. W. Chien 9 Jul. 1980 22 p refs
Submitted for publication Prepared in cooperation with Massachusetts Univ., Amherst
(Contract N00014-75-C-0982; NR Proj. 358-802)
(AD-A088843; LRSM-TR-80-7) Avail: NTIS HC A02/MF A01 CSCL 11/9

The results of an initial study of the microwave properties of low density foam-like (CH) sub x are reported for intermediate dopant levels. The electrical conductivity and dielectric constant are obtained at microwave frequencies, and the results are analyzed in terms of effective medium theory. The possibility of utilizing the doped foam-like (CH) sub x as an efficient microwave absorber is discussed. GRA

N80-32519# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
ELECTRICALLY CONDUCTIVE MACROMOLECULES VIA COFACIAL ASSEMBLY TECHNIQUES Interim Report
Carl W. Dirk, Joseph W. Lyding, Karl F. Schoch, Jr., Carl R. Kannewurf, and Tobin J. Marks 17 Jul. 1980 12 p refs
Submitted for publication
(Contract N00014-77-C-0231; Grant NSF DMR-76-80847; NR Proj. 053-640)
(AD-A087554; TR-12) Avail: NTIS HC A02/MF A01 CSCL 07/4

The properties of low-dimensional mixed valence material consisting of molecular stacks are critically dependent on the rather capricious and unpredictable intermolecular forces that dictate whether stacks form, whether the stacks are segregated, the orientation of donor with respect to acceptor, the relative orientation of units within a stack, and the stacking repeat distance. Discussed in this lecture are rational approaches to overcome such problems by combining polymer chemistry with recently developed methodology for synthesizing stacked, partially oxidized metallomacrocycles and for measuring the degree of incomplete charge transfer. New results on the chemical, structural, and electronic properties of highly conductive macro-molecules prepared by covalently linking metallomacrocycles in a rigid, face-to-face configuration as shown below, followed by doping, are presented. GRA

N80-32520# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
MECHANICAL PROPERTIES VERSUS MORPHOLOGY OF ORDERED POLYMERS Progress Report, 1 Sep. 1978 - 30 Aug. 1979
Edwin L. Thomas, R. J. Farris, and S. L. Hsu Wright-Patterson AFB, Ohio AFWAL May 1980 95 p refs
(Contract F33615-78-C-5175)
(AD-A087927; AFWAL-TR-80-4045) Avail: NTIS HC A05/MF A01 CSCL 11/9

Morphological techniques in conjunction with mechanical testing have been employed to determine the relationships between mechanical properties and morphology of a new class of high strength, high modulus, thermally stable aromatic heterocyclic polymers. The polymers studied were poly-p-phenylene benzobis-oxazole (PBO) and predominantly ploy-p-phenylene benzobisthiazole (PBT). The microstructural studies involved laser Raman and Fourier transform infrared spectroscopy, electron diffraction and electron microscopy, wide and small angle X-ray scattering and birefringence measurements. Mechanical measurements have employed ambient and high temperature mechanical testing as a function of strain rate and state of stress (uniaxial tension, double loop bending). The effect of processing conditions on fiber morphology and subsequently on mechanical properties has been studied for optimization of processing conditions for high strength and modulus rigid rod polymer fibers and films. GRA

N80-32521# Solar Turbines International, San Diego, Calif.
STUDY OF EROSION MECHANISMS OF ENGINEERING CERAMICS, STATIC FATIGUE OF CERAMICS Final Report, 1 Apr. 1973 - 1 Jan. 1980
Mary Ellen Gulden 31 Jul. 1980 58 p refs
(Contract N00014-73-C-0401; NR Proj. 032-542)
(AD-A087959; MD80-37-BK) Avail: NTIS HC A04/MF A01 CSCL 11/2

Two areas were investigated in this program: solid particle erosion of engineering ceramics and static fatigue of ceramics. In the erosion phase, the target materials investigated were several types of Si3N4, glass bonded Al2O3 and magnesium fluoride. The particle types were SiC and natural quartz sand. Particle sizes ranged between 10 and 1000 microns and particle velocities were in the subsonic regime. The particle size and velocity dependence on erosion, effect of erosion on strength and effect of number of impacts on erosion were determined. It was found that the type of erosion damage produced was more a function of relative target particle properties than of particle size and velocity for the erosion regime investigated. 'Elastic-plastic' impact, which is characterized by plastic deformation in the particle contact area, and radial and lateral cracks propagating outward from the contact area was observed on all targets impacted with SiC particles. Damage from quartz particle impact ranged from elastic-plastic on the relatively soft targets like MgF2 to shallow intergranular chipping with no secondary crack formation for the hard targets such as hot-pressed Si3N4. Static fatigue behavior of four ceramics was determined in various aqueous solutions at temperatures to 900 C. GRA

N80-32522# McDonnell Aircraft Co., St. Louis, Mo. Design Engineering Power and Fluid Systems Dept.
ADVANCED FLUID SYSTEM SIMULATION Final Report, 1 Jun. 1978 - 31 Jan. 1980
H. DeGarcia, R. F. Deshazer, R. J. Levek, Neil J. Pierce, and M. J. Stevens Wright-Patterson AFB, Ohio AFWAL Apr. 1980 770 p refs
(Contract F33615-78-C-2026; AF Proj. 3027)
(AD-A088060; AFWAL-TR-80-2039) Avail: NTIS HC A99/MF A01 CSCL 09/2

The report describes the continued development and test verification of digital computer models used to simulate hydraulic systems under dynamic conditions. A hydraulic acoustic generator was built and tested for frequency response work. Pulsation attenuation techniques are presented and several modifications were made to the Hydraulic Frequency Response Computer Program (HSFR) including a standing wave plot option. An empirical time domain pump model was developed and additional verification and development of the piston pump transient model was accomplished. Several enhancements were made to the Hydraulic Transient Analysis Computer Program (HYTRAN). A quasi-transient capability was added to the Steady State Flow Analysis Computer Program (SSFAN). The SSFAN Program was updated to extend the calculation capability, add new component models, program features, and reduce the program size. Several programming features were added to the Hydraulic Transient Thermal Analysis Computer Program (HYTTHA) including a temperature default section and environment section. Further verification work was accomplished on the HYTTHA program. GRA

N80-32523# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
OXIDATIVE STABILIZATION OF ACRYLIC FIBERS. PART 5: THE DECOLORATION REACTION
S. S. Chen, J. Herms, L. H. Peebles, Jr., and D. R. Uhlmann Aug. 1980 73 p refs
(Contract N00014-75-C-0542; NR Proj. 356-534)
(AD-A088299; TR-13) Avail: NTIS HC A04/MF A01 CSCL 11/9

When acrylic fibers are heat treated for various times at 220-250 C, they form dark, insoluble structures of uncertain chemical character which are inert to many strong oxidizing and reducing agents. The heat treated fibers are, however, rapidly decolored by warm alkaline hypochlorite solutions. When fibers which have undergone short time heat treatment are subjected to the hypochlorite, incubation periods are observed before decoloration is noted; and a swollen acrylic network remains after decoloration is complete. The acrylic network is primarily unreacted precursor units save for a small amount of hydrolyzed material. The decoloration reaction is zero order, indicating a reaction at the surface. Prior to the decoloration reaction, there is a penetration or plasticization of the subsurface material by

elements of the solution, as indicated by the presence of chlorine atoms in the interiors of exposed fibers. The rate of the decoloration reaction increases with increasing duration of the stabilization heat treatment. The precise structure of the final material depends therefore on the original fiber composition and the processing variables. GRA

N80-32524# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
ENGINEERING PROPERTIES OF MULTIPHASE BLOCK COPOLYMERS Final Report, 15 Jul. 1976 - 30 Apr. 1980
Andrew J. Wnuk, Thomas C. Ward, and James E. McGrath 20 Jul. 1980 103 p refs
(Grant DAAG29-76-G-0312)
(AD-A088327; ARO-14072.7-C) Avail: NTIS HC A06/MF A01 CSCL 11/9

Multiblock (A-B)n copolymers of bisphenol-A polycarbonate and several poly(arylether sulfones) have been investigated. The copolymers were prepared from hydroxyl terminated oligomers by an interfacial technique which utilized phosgene as the coupling agent. Characterization of the oligomers and copolymers included end group analysis, UV-Visible Spectroscopy, membrane osmometry, and gel permeation chromatography. GRA

N80-32525# De Soto, Inc., Des Plaines, Ill.
HIGH SOLIDS COATING SYSTEM Final Report, 5 Feb. 1979 - Feb. 1980
Gretchen L. McKay and Ashok K. Chattopadhyay Jun. 1980 62 p refs
(Contract F33615-79-C-5007; AF Proj. 2422)
(AD-A088225; AFWAL-TR-80-4073) Avail: NTIS HC A04/MF A01 CSCL 11/9

This contract research effort, a continuation of a previous Air Force supported contract (F33615-77-C-5101), was directed toward the development of a 65% volume solids, sprayable (airless electrostatic method), polyurethane exterior aircraft coating meeting MIL-C-83286B performance specifications. A high solids coating can significantly reduce solvent emissions and help the Air Force meet EPA/OSHA requirements for reduced environmental pollution and increased worker safety. One formulation, consisting of a combination of Acryloid AU-568 (oxazolidine), NIAX PCP-0300 (polyol), and Desmodur N-100 (polyisocyanate) was developed under the initial contract and found to exhibit performance properties closely approximating the program goals. During the present contract, this formulation was further evaluated. Attempts to upgrade the properties not meeting the performance specifications were made. Also, new commercially available resins were evaluated for incorporation into the high solids systems. GRA

N80-32526# Northwestern Univ., Evanston, Ill. Materials Research Center.
THERMALLY STIMULATED DISCHARGE CURRENT ANALYSIS OF EPOXY RESINS Annual Report, Feb. 1978 - Jan. 1980
T. D. Chang, H. Ueda, S. H. Carr, and J. O. Brittain 30 Jul. 1980 36 p
(Contract N00014-78-C-0276; NR Proj. 356-677)
(AD-A088213; TR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

Network polymers resins have been prepared from selected binary combinations of diglycidl ether of butanediol or diglycidl ether of bisphenol A with ethylene diamine, diethylene triamine, diaminodiphynyl methane, or diaminodiphenyl sulfone. Thermally stimulated discharge current analyses were performed on these materials in an effort to elucidate significant molecular motions through the temperature range, approximately 80 K to 460 K. Assignments of dielectrically and mechanically active loss processes to motions involving penyl groups, pendant hydroxyl groups, or aliphatic backbone segments could be made in cases where there were clear indications based on the temperature-dependence of activation energy. GRA

N80-32527# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
COLLECTOR SEALANTS AND BREATHING Final Report, 25 Sep. 1978 - 31 Dec. 1979
M. A. Mendelsohn, R. M. Luck, F. A. Yeoman, and F. M. Navish, Jr. 20 Feb. 1980 278 p refs
(Contract DE-AC04-78CS-15362)
(DOE/CS-15362/1) Avail: NTIS HC A13/MF A01

The pertinent properties of a variety of possible sealants for solar collectors were investigated, the most promising candidates were identified, and the effect of breathing in flat plate, thermal solar collector units was studied. Two types of sealants, Class PS which includes preformed seals or gaskets and Class SC which includes sealing compounds or caulks were considered. Environmental stresses evaluated include elevated temperatures, moisture, ultraviolet light, ozone and oxygen, and fungus. Factors such as design, fabrication, materials of construction, seals and sealing techniques and absorber plate coatings were observed on actual field units removed from service. Such phenomena as leakage, corrosion and formation of deposits on glazing and absorber plate were noted. The properties of several desiccants were evaluated in order to provide means to mitigate the deleterious effects of water on collector life. Adsorbents for organic degradation products of sealants were also investigated in order to protect the glazing and absorber plate from deposited coatings. DOE

N80-32528# Sandia Labs., Albuquerque, N. Mex.
GLASSES AND GLASS CERAMICS FOR SEALING TO ALUMINUM ALLOYS
James A. Wilder, Jr. 1979 6 p refs Presented at the 12th Intern. Glass Congr., Albuquerque, N. Mex., Jul. 1980
(Contract EY-76-C-04-0789)
(SAND-79-1405C; CONF-800705-2) Avail: NTIS HC A02/MF A01

Alkali alkaline Earth phosphate glasses which hermetically seal to aluminum alloys were developed. They have coefficients of thermal expanson greater than 200 x 10 to the minus 7th power/C and glass transition temperatures below 400 C. The relatively low fracture toughness values of the glasses increase by approximately 25% when the glasses are converted into glass ceramics. DOE

N80-32529# California Univ., Livermore. Lawrence Livermore Lab.
STRUCTURE-PROPERTY RELATIONSHIPS OF LINEAR METHYL-PHENYL-VINYL SILOXANE TERPOLYMERS
H. G. Hammon, E. S. Jessop, J. R. Kolb, and M. O. Riley 8 May 1980 10 p refs Presented at the Meeting of JOWOG, Kansas City, Mo., 25 Jun. 1980 and at the Am. Chem. Soc. Natl. Meeting, San Francisco, Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84303; CONF-800814-2; CONF-800828-2) Avail: NTIS HC A02/MF A01

The synthesis and characterization of siloxane polymers with properties tailored to meet specific design requirements is addressed. A series of 15 random terpolymers of dimethyl-diphenyl-methylvinyl siloxane were synthesized. In seven terpolymers the concentration of the methylvinyl repeat unit was varied from 0 to 5 weight percent maintaining phenyl content constant at 12 percent. The other eight terpolymers contained 0 to 18 weight percent phenyl repeat unit maintaining vinyl at one percent. The moduli increased directly with vinyl concentration, but the longation to break decreased until, at about two percent vinyl, the rubber becomes extremely friable. Increasing the phenyl content in the silicone decreased the degree of crystallinity and increases the polymer class transition in accord with theoretical predictions. The major effect of incorporation of phenyl groups is the elimination of the polymer's ability to crystallize at about three percent phenyl. This extends the rubbery plateau to the glass transition (-117 C) instead of the melting point (-44 C). DOE

N80-32530# California Univ., Livermore. Lawrence Livermore Lab.
SYNTHESIS AND CHARACTERIZATION OF NEW SILICONE CONDENSATION POLYMERS
N. L. Butler, H. G. Hammon, E. S. Jessop, J. R. Kolb, and M. O. Riley 8 May 1980 7 p refs Presented at the Meeting of JOWOG, Kansas City, Mo., 28 Jun. 1980 and at the Am. Chem. Soc. Natl. Meeting, San Francisco, Aug. 1980 Submitted for publication

(Contract W-7405-eng-48)
(UCRL-84304; CONF-800814-1; CONF-800628-3) Avail: NTIS HC A02/MF A01

The synthesis of polysiloxanes as base polymers for cellular silicone materials is discussed. The polymers which are prepared via random equilibration of various cyclic tetrasiloxanes have adequate properties for certain applications but there is evidence to suggest that alternating block polysiloxanes prepared via condensation polymerization techniques have properties more desirable for use as flexible foam materials. The synthetic sequence involves reactions of functionally terminated (amino and hydroxy) polysiloxane oligomers to produce alternating block materials of high molecular weight dialkylamines as condensation by-products. Functional endcapping of these poly(dimethyl-diphenyl-methyl vinyl) siloxane copolymers with dimethylvinylsilyl groups is discussed. DOE

N80-32531# Hanford Engineering Development Lab., Richland, Wash.
CR-39 POLYMER, A PROMISING NEW SOLID STATE TRACK RECORDER FOR HIGH ENERGY NEUTRON APPLICATIONS
F. H. Ruddy, C. C. Preston (San Francisco Univ.), R. Gold, E. V. Benton, and J. H. Roberts (Macalester Coll.) 14 Apr. 1980 22 p refs
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2149; CONF-800551-20) Avail: NTIS HC A02/MF A01

The CR-39 polymer, a solid state track recorder with unprecedented sensitivity to lightly ionizing particles (such as protons) is developed for eventual neutron dosimetry applications. The diameters of proton tracks are found to vary smoothly and reproducibly as a function of energy from 0.20 to 18.0 MeV. Preliminary results on the response of CR-39 polymer to proton tracks as a function of angle show a rapid decrease of the registration efficiency from 100% to 0 for incidence less than 7 degrees. Proton recoil track size distribution in CR-39 polymer irradiated with monoenergetic neutrons of varying energy are presented. Some proposed high energy netron dosimetry and radiography systems using CR-39 polymer are discussed. DOE

N80-32532# Kansas State Univ., Manhattan. Dept. of Chemistry.
THE SYNTHESES OF NITRATE AND NITRITE SELECTIVE POLYMERS Ph.D. Thesis
Shang-Jaw Chiou 1979 175 p refs
(PB80-195076; W80-05462; OWRT-A-979-Kan(2)) Avail: NTIS HC A08/MF A01 CSCL 07C

A high capacity nitrate and nitrite selective polymer was synthesized by attaching nitron to commercial polyvinylbenzyl chloride (60/40 ortho/para isomers). The capacity of this polymer to remove nitrate and nitrite from 0.001 M solution was 67% and 42% respectively. The compound 1 phenyl 2 diethylaminoethyl 4 amino benzoate was also synthesized and attached to commercial polyvinylbenzyl chloride. The nitrate and nitrite selectivity of this polymer was realized and the capacity of this polymer to remove nitrate and nitrite from aqueous solution was 76% and 65.6%, respectively. Another polymer was synthesized by attachment of 1 (4 nitrophenyl) 2 diethylaminoethyl 4 hydroxybenzoate to polyvinylbenzyl chloride (60/40 o/p isomers). The capacity of this polymer to remove nitrate and nitrite from aqueous solution was 80% and 68%, respectively. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-32533*# Lockheed-California Co., Burbank.
STUDY OF METHANE FUEL FOR SUBSONIC TRANSPORT AIRCRAFT Final Report, Jan. 1978 - Aug. 1979
L. K. Carson, G. W. Davis, E. F. Versaw, George R. Cunnington, Jr., and E. J. Daniels Sep. 1980 371 p refs
(Contract NAS1-15239)
(NASA-CR-159320; LR-29157) Avail: NTIS HC A16/MF A01 CSCL 21D

The cost and performance were defined for commercial transport using liquid methane including its fuel system and the ground facility complex required for the processing and storage of methane. A cost and performance comparison was made with Jet A and hydrogen powered aircraft of the same payload and range capability. Extensive design work was done on cryogenic fuel tanks, insulation systems as well as the fuel system itself. Three candidate fuel tank locations were evaluated, i.e., fuselage tanks, wing tanks or external pylon tanks. R.C.T.

N80-32534# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
SENSITIVITY OF SOME EXPLOSIVE/BRINE MIXTURES Final Report
M. S. Kirshenbaum, J. R. Leccacorvi, and S. Portnoy Aug. 1980 20 p refs
(AD-A087939; AD-E400455; ARLCD-TR-80021; DRXTH-IS-TR-80057) Avail: NTIS HC A02/MF A01 CSCL 19/1

Threshold levels were determined for the dried explosive and propellant contaminated salts derived from the decontamination brine solution used for the demilitarization of chemical munitions at the Chemical Agent Munition Disposal System Directorate demilitarization facility. Impact, friction and thermal sensitivity tests revealed that the thermal hazard was the controlling factor in determining the safe explosive concentrations. The test method used shows there is no thermal hazard if the total concentrations of the energetic materials are not greater than 10% by weight. GRA

N80-32535# Hazards Research Corp., Denville, N. J.
SENSITIVITY OF MOLTEN AND SOLID TNT CHARGES TO IMPACT BY PRIMARY STEEL FRAGMENTS Final Report
George Petino, Jr., Michael F. Leondi, and Paul D. Price Aug. 1980 66 p refs
(Contract DAAK10-77-C-0155)
(AD-A087750; AD-E400394; ARLCD-CR-79025) Avail: NTIS HC A04/MF A01 CSCL 19/1

An experimental program was conducted to establish the sensitivity of molten and solid TNT to impact by nonspinning, primary steel fragments weighing 14 to 42 grams (0.5 to 1.5 oz) and traveling at velocities of 1,057 to 2,180 m/s (3,466 to 7,152 fps). Parameters that were varied included the absence or presence of steel acceptor plates, fragment weight per unit impact area and the molten vs. solid physical state of the TNT. GRA

N80-32536# Air Force Engineering and Services Center, Tyndall AFB, Fla. Environics Div.
BIOLOGICAL DEGRADATION OF HYDRAZINE Final Report, Jun. 1977 - Aug. 1978
Michael G. MacNaughton, Jay A. Farmwald, Larry McDaniels, and Gregory Urda Oct. 1979 46 p refs
(AF Proj. 2103)
(AD-A084426; AFESC/ESL-TR-79-38; CEEDO-TR-78-13) Avail: NTIS HC A03/MF A01 CSCL 13/2

Due to the increased procurement, storage, and transportation of hydrazine (HZ) in support of the Titan and Minuteman operational missiles, the space shuttle, and F-16 combat fighter programs, the Air Force Engineering and Services Laboratory has been tasked with documenting the effects of fuel spills and low level continuous flow discharges on publicly owned treatment works (POTW). Using 12 bench scale continuous flow recycle reactors, it was shown that treatment efficiency (as measured by COD removal) is not seriously impaired for slug doses which increase aeration basin HZ concentrations up to 44 mg/l. Chemical oxygen demand (COD) recovery times for slug doses of 243 mg/l were approximately 4 to 5 days. Nitrification ceased at HZ concentrations above 23 mg/l. The 'no effect' concentration with respect to ammonia oxidation was determined to be between 1 to 23 mg/l while nitrate recovery times for doses up to 243 mg/l wave were on the order of 10 days. Continuous influent HZ concentrations above 10 mg/l seriously degrade COD

removal capabilities. Nitrification under continuous feed conditions was inhibited above 1 mg/l. Author

N80-32537# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.

NATIONAL AVIATION FUEL SCENARIO ANALYSIS PROGRAM (NAFSAP). VOLUME 1: MODEL DESCRIPTION. VOLUME 2: USER MANUAL Final Report

Stephen G. Vahovich Mar. 1980 117 p

(AD-A084235; FAA-EE-80-12) Avail: NTIS HC A06/MF A01 CSCL 01/3

Forecasts of air carrier jet fuel usage by body type for three user defined markets are given. The model contains options which allow the user to easily change the composition of the future fleet so that fuel usage scenarios can be 'run'. The structure of the model is described. A computer users mannual is provided. T.M.

N80-32538# Ballistic Research Labs., Aberdeen Proving Ground, Md.

IGNITION OF NOS 365 LIQUID PROPELLANT CONTAINING AN AIR BUBBLE UNDER SIMULATED VREECH PRESSURIZATION CONDITIONS Final Report

Vincent M. Boyle and Edwin A. OLeary Apr. 1980 42 p

(DA Proj. 1L1-61102-AH-80)

(AD-A085723; AD-E430452; ARBRL-TR-02236) Avail: NTIS HC A03/MF A01 CSCL 21/9

A setback simulator was used to generate pressure within a liquid propellant containing a suspended air bubble. The bubble volume was varied from 1 to 200 micro liters. Several tests were made using a 1000 micro liter air space above the liquid propellant. Conclusions reached were: (1) a suspended air bubble makes liquid propellant more sensitive to pressure ignition; (2) the intensity of the reaction appears to increase with bubble size; (3) higher pressurization rates cause ignition of neat liquid propellant. However, this may be due to extrusion of the propellant around the pistons; and (4) the impact mode of activator operation, although permitting higher pressures and pressurization rates than the contact mode, also gives more variability in the results. S.F.

N80-32539# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

TRANSIENT IGNITION MECHANISMS OF CONFINED SOLID PROPELLANTS UNDER RAPID PRESSURIZATION Summary Report, 1 Aug. 1979 - 31 Jul. 1980

Kenneth K. Kuo, Mridul Kumar, and Anil K. Kulkarni 6 Aug. 1980 58 p refs

(Contract N00014-79-C-0762)

(AD-A088080) Avail: NTIS HC A04/MF A01 CSCL 21/9

A comprehensive theoretical model was formulated to study the transient ignition mechanisms of solid propellants under rapidly varying pressure conditions. The model considers a two dimensional geometry to describe the ignition of a heterogeneous propellant. The rate of pressurization has been included in the energy equation to simulate rocket motor ignition conditions. The model does not make any a priori assumption of solid phase, heterogeneous, or gas phase ignition mechanism. Chemical reactions are considered in the gas phase, at the interface as well as in the subsurface. The most up to date chemical kinetics information is included in the model. A generalized ignition criterion has been proposed which allows ignition to occur at any site. GRA

N80-32540# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

SERVICE TEST OF TWO FUEL CONDUCTIVITY ADDITIVES Final Report, 1 Apr. 1977 - 1 Jan. 1980

Charles R. Martel and Frank P. Morse May 1980 86 p refs

(AD-A088046; AFWAL-TR-80-2051) Avail: NTIS HC A05/MF A01 CSCL 21/4

A service test of two fuel conductivity (anti-static) additives was conducted from April 1977 to May 1979 at eight Air Force bases. Since bases have continued to use the additive, a portion of the data reported herein extends to January 1980. The two candidate fuel additives were Shell Chemical Company's ASA-3 and E.I. duPont de Nemours and Company's Stadis 450. The additives were injected into the JP-4 aviation turbine fuel at either the refinery or terminal supporting the base. The conductivity of the JP-4 delivered to the service test base was to be maintained between 200 and 600 pS/m. The minimum and maximum fuel conductivity limits for servicing to aircraft was 100 to 700 pS/m. The effects of the additives on the air base fuel systems, filter separator elements, and on aircraft were monitored. GRA

N80-32541# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.

DETONATIONS AND MOLECULAR ELECTRONIC STRUCTURE OF EXPLOSIVES: THEORY AND ITS APPLICATION TO (NO +) SUB n Technical Report, Oct. 1977 - Dec. 1978

Richard D. Bardo 30 May 1980 58 p refs

(ZR01301; ZR01305)

(AD-A088223; NSWC/TR-79-175) Avail: NTIS HC A04/MF A01 CSCL 19/1

The theory of the electronic structure of molecular systems is discussed. It is suggested that certain electronic excited states are diminished in energy during compression, and that intersections of ground and excited state potential energy surfaces occur, thereby creating much lower activation energy barriers and greatly enhancing reaction rates. The molecular system (NO+)n is treated as a prototype explosive system. Ab initio and semiempirical calculations on the ground and excited electronic states of (NO+)n are presented. Intersections of the surfaces are seen to occur, suggesting that at high compressions the activation energy for bond scission may be substantially reduced. It is also shown that the changes in excitation energies depend primarily on the interactions of two or three NO(+) molecules, which suggests an enormous simplification in the study of excited states. GRA

N80-32542# Air Force Academy, Colo. Frank J. Seiler Research Lab.

PREDICTED PERFORMANCE OF ENERGETIC PLASTICIZER FORMULATIONS

Larry P. Davis, Robert A. Hildreth, and Melvin L. Druelinger Jun. 1980 20 p refs

(AF Proj. 2303)

(AD-A087658; FJSRL-TR-80-0015) Avail: NTIS HC A02/MF A01 CSCL 21/9

Calculations of heats of formation (MNDO) and specific impulse for a series of bis-fluorodinitroethyl alkyl ethers have been made. This series also included oxygen and sulfur hetero atoms, N-H, N-NO2 and CFNO2 substituents. These calculations reveal a trend toward decreasing Isp values as the hydrocarbon chain increases. The results suggest that ideal target molecules for synthetic efforts are the smaller members of this family of compounds, and that such compounds could be of value in applications as energetic plasticizers in propellant/munition formulations. The results also indicate that these compounds are promising in view of their increased performance compared to formulations using non-energetic plasticizers. GRA

N80-32543# Germantown Labs., Inc., Philadelphia, Pa.

INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS FIRE TUBE TEST APPARATUS DESIGN AND CONSTRUCTION Quarterly Report, 1 Oct. - 31 Dec. 1979

Norman H. Cherry and Charles S. Stokes Jan. 1980 15 p

(Contract EF-77-C-01-2689)

(FE-2689-T4; QR-9) Avail: NTIS HC A02/MF A01

The fire tube test apparatus was operated at design capacity, 1,000,000 Btu's per hour, using No. 6 Gulf oil. Burner refinements were made for flowmeter accommodations. A test plan for the combustion studies is presented. DOE

N80-32544# Argonne National Lab., Ill. Energy and Environmental Systems Div.

ALCOHOL PRODUCTION FROM AGRICULTURAL AND FORESTRY RESIDUES

R. Opilla, L. Dale, and T. Surles May 1980 30 p refs

(Contract W-31-109-eng-38)

(ANL/EES/TM-88) Avail: NTIS HC A03/MF A01

Technologies available for the production of ethanol from whole corn are reviewed with emphasis on the environmental aspects of the process, including land utilization and possible air and water pollutants. Changes intended to improve the

economics of the process as well as to reduce some of the pollution from by-product disposal are suggested. Ethanol may be derived from renewable cellulosic substances by either enzymatic or acid hydrolysis of cellulose to sugar, followed by conventional fermentation and distillation. The use of two corn stover (field stalks remaining after harvest) and straw from wheat crops as a cellulosic feedstock is discussed. The environmental impact of a two stage acid process and an enzymatic process for feedstock production is evaluated and residuals expected from the manufacture of methyl and ethyl alcohols from woody biomass are considered. The methanol is produced in a gasification process, whereas ethanol is produced by hydrolysis and fermentation processes similar to those used to derive ethanol from cellulosic materials. DOE

N80-32545# Dynatech Corp., Cambridge, Mass
LIQUID FUELS PRODUCTION FROM BIOMASS Progress Report, 1 Oct. - 31 Dec. 1979
J. E. Sanderson, P. F. Levy, D. L. Wise, M. R. Nabor, M. S. Molyneaux, and C. A. Hughes 1 Feb. 1980 67 p refs
(Contract DE-AC02-77ET-20050)
(COO-4388-10; Rept-1987; PR-10) Avail: NTIS HC A04/MF A01

It was found that marine algae could be converted to higher aliphatic organic acids and that these acids could be readily removed from the fermentation broth by membrane or liquid-liquid extraction. It was then proposed to convert these higher organic acids via Kolbe Electrolysis to aliphatic hydrocarbons, which may be used as a diesel fuel. A coenzyme M analogue, 2-bromoethanesulfonic acid was shown to be an effective suppressor of methane in nonsterile anaerobic fermentation of cellulosic substrates. Preliminary experiments were completed utilizing corn meal in which 2-bromoethanesulfonic acid and carbon monoxide were both found to be effective methane suppressors. The energy outputs and requirements for the production of liquid hydrocarbon fuel from corn are analyzed. As a means of expanding the number of potential substrates, pretreatment schemes are being investigated. DOE

N80-32546# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1 Dec. 1979 - 29 Feb. 1980
Alex G. Alexander, W. Allison, M. Garcia, G. Ramirez, T. L. Chu, J. Velez-Santiago, and L. Smith 1980 39 p refs
(Contract ET-78-S-05-5912)
(DOE-ET-20071/T1; QR-3) Avail: NTIS HC A03/MF A01

Research continued on tropical grasses from Saccharum and related genera as sources of intensively propagated fiber and fermentable solids. Candidate screening (for short rotation grasses) was expanded to include six sorghum x Sudan grass hybrids developed by the Dekalb Company. Incomplete data indicate that two of the new grasses might be comparable to the NK hybrids in total biomass production and drought tolerance. Sugar-cane and napier grass yield trends in year 3 includes: (1) increased yields with delay of harvest frequency; (2) lack of response to close spacing; (3) a superiority of napier grass over sugarcane when harvested at intervals of six months or less; and (4) a general superiority of the sugarcane variety NCo 310 over varieties PR 980 and PR 64-1791. Delayed tasseling of a wild, early flowering S spontaneous hybrid enabled three crosses to be made in December using commercial hybrids as female parents. Approximately 1000 seedlings were produced. DOE

N80-32547# Argonne National Lab., Ill. Energy and Environmental Systems Div.
ASSESSMENT OF PERUVIAN BIOFUEL RESOURCES AND ALTERNATIVES
Jerome P. Harper, Wayne Smith (Florida Univ., Gainesville), and Eliseo Mariani (Marelco, Inc.) Aug. 1979 57 p refs
(Contract W-31-109-eng-38)
(ANL/EES/TM-86) Avail: NTIS HC A04/MF A01

Appraisal of the biofuel potential of Peru was based on: determination of current biofuel productivity; identification of Peruvian agricultural and forestry resources; assessment of resource development and management concerns; identification of market considerations; description of biofuel technological options; and identification of regional biofuel technology applications. Nine biofuel technology options for Peru are identified: (1) small to medium scale gasification; (2) a wood waste inventory; (3) stationary and mobile charcoal production systems; (4) wood distillation; (5) forest resource development and management; (6) electrical cogeneration; (7) anaerobic digestion technology; (8) development of ethanol production capabilities; and (9) agricultural strategies for fuel production. Applications of these biofuel options are identified for each of the three major regions of the country. DOE

N80-32548# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Solar Energy.
FIRST REPORT TO CONGRESS ON THE USE OF ALCOHOL IN MOTOR FUELS Annual Report
1 Apr. 1980 62 p
(DOE/CS-0165; AR-1) Avail: NTIS HC A04/MF A01

The following information is presented: (1) a description of the firms engaged in the alcohol fuel industry; (2) the amount of alcohol fuels sold in each state and the amount of gasoline saved in each state by reason of the use of alcohol fuels; (3) the revenue loss resulting from the exemptions from tax for alcohol fuels; and (4) the cost of production and the retail cost of alcohol fuels as compared to gasoline and special fuels before the imposition of any Federal excise tax. During 1979, a rapid increase in marketing of alcohol fuel, specifically the 10% blend known as gasohol, has caused a significant gap between the motor fuel marketplace and the information system(s) that compile a consistent data base for domestic energy production and consumption. DOE

N80-32549# Mound Lab., Miamisburg, Ohio.
ROLE OF Al SUBSTITUTION ON HYDROGEN DIFFUSION IN BETA-LaNi5Al/SUB y/H/SUB x
R. C. Bowman, Jr., B. D. Craft, A. Attalla, M. H. Mendelsohn, and D. M. Gruen 1980 13 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980 Prepared in cooperation with Argonne National Lab., Ill.
(Contract DE-AC04-76DP-00053)
(MLM-2733(OP); CONF-800402-14) Avail: NTIS HC A02/MF A01

Proton relaxation times measured by NMR pulse techniques were used to investigate hydrogen diffusion behavior in beta LaNi/sub 5-y/Al/sub y/H/sub x/ for $0 < y < 1.5$. Al substitution increases E/sub a/ with a subsequent reduction in the apparent diffusion constants by more than two orders of magnitude relative to beta-LaNi sub 5 H sub 6 when $y > or = 1$. T sub 1 and T sub 1 sub rho/ values from high purity samples suggest that two types of jump processes with different activation energies are probably involved. DOE

N80-32550# Los Alamos Scientific Lab., N. Mex.
STUDIES OF FAST REACTIONS IN DETONATIONS
Charles L. Mader 1980 13 p refs Presented at NATO Adv. Study Inst. on Fast Reactions in Energetic Systems, Ioannion, Greece, 6-19 Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1282; CONF-800714-1) Avail: NTIS HC A02/MF A01

The time dependent behavior of the flow in reaction zones of the detonating homogeneous explosives nitromethane, liquid TNT, and ideal gases was investigated using one and two dimensional Lagrangian and Eulerian numerical hydrodynamics with Arrhenius chemical reaction. A general model for bulk decomposition of heterogeneous explosives, called Forest Fire, was developed, which gives the rate of explosive decomposition as a function of local pressure. The model permits description of the process of heterogeneous explosive initiation, propagation, and failure. DOE

N80-32551# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENTAL STUDIES OF CONSTITUTIVE MODELS FOR PLASTIC-BONDED EXPLOSIVES
Robert M. Hackett (Army Missile Command, Redstone Arsenal, Ala.), Randall L. Peeters, and William R. Oakes, Jr. Jun. 1980 12 p refs
(Contract W-7405-eng-36)

(LA-8204-MS) Avail: NTIS HC A02/MF A01

Typically, elastic and elastic-plastic theory are used in structural analysis computer programs to model the mechanical behavior of high explosives; these models, however, do not fit the observed behavior of plastic bonded explosives. The development of an equation of state creep model and a linear viscoelastic model for the analysis of these material systems is discussed and comparisons between experimental results and analytical model predictions are shown. DOE

N80-32552# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

MODIFICATIONS FOR USE OF METHANOL OR METHANOL-GASOLINE BLENDS IN AUTOMOTIVE VEHICLES Technical Report, Sep. 1970 - Jan. 1980

D. J. Patterson, J. A. Bolt, and D. E. Cole Jan. 1980 194 p refs

(Contract DE-AC04-76CS-53682)

(ALO-3682-T1) Avail: NTIS HC A09/MF A01

Potential problems in the use of methanol or blends of methanol and gasoline as automotive fuels are examined. Retrofitting of existing vehicles as well as future vehicle design is considered. Several potentially serious problems are identified with methanol use. The most attractive solutions depend upon an integrated combination of vehicle modifications and fuel design. No vehicle problems are found which could not be solved with relatively minor developments of existing technology providing the methanol or blend fuel was itself engineered to ameliorate the solution. Research needs are identified in the areas of lubrication and materials. Because of the substantial costs and complexities of a retrofitting program, use of methanol must be evaluated in relation to other petroleum saving alternatives. Future vehicles can be designed initially to operate satisfactorily on these alternate fuels. However a specific fuel composition must be specified around which the future engines and vehicles can be designed. DOE

N80-32553# Brookhaven National Lab., Upton, N. Y.

HYDROGEN PRODUCTION FROM REMOTE POWER SITES

A. Mezzina, G. Grimes (DOE), R. Reeves (DOE), and R. Wiley (New York State Energy Research and Development Authority) Feb. 1980 10 p refs Presented at the Energy Sources Technol. Conf. and Exhibition, New Orleans, 3-7 Feb. 1980

(Contract EY-76-C-02-0016)

(BNL-27457; CONF-800204-9) Avail: NTIS HC A02/MF A01

The basic concept for adopting small existing dams to hydrogen production entails the energy conversion steps: hydropower to shaft power via a hydraulic turbine; shaft power to electrical power via a generator; and electrical power to hydrogen (and oxygen) via a water electrolyzer. The resource availability is discussed. The concept implementation in Potsdam, New York is mentioned. DOE

N80-32554# Oak Ridge National Lab., Tenn. Chemical Technology Div.

MODELING AND EVALUATION OF DESIGNS FOR SOLID HYDROGEN STORAGE BEDS

P. W. Fisher and J. S. Watson 1980 11 p refs Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23-26 Jun. 1980

(Contract W-7405-eng-26)

(CONF-800616-8) Avail: NTIS HC A02/MF A01

Mathematical models were developed to predict the performance of metal hydride beds used for hydrogen storage. The relative importance of heat transfer, mass transfer, chemical kinetics, and equilibrium were evaluated through comparison of the models with experimental data supplied by Brookhaven National Laboratory for a cylindrical bed containing FeTi alloy. An equilibrium model containing no empirical parameters produced bed pressure and temperature which showed good agreement with experimental data. This model was used to evaluate two proposed designs for solid hydrogen storage beds in which (1) FeTi alloy was contained in tubes that were externally cooled, and (2) FeTi alloy was contained in a bed that were penetrated by cooling tubes. The model predicts that heat transfer surface area is utilized most effectively with the second cooling configuration. DOE

N80-32555# Department of Energy, Washington, D. C. Div. of Coal Conversion.

COAL DEMONSTRATION PLANTS Quarterly Report, Apr. - Jun. 1979

Apr. 1980 75 p

(DOE/FE-0004/79-2) Avail: NTIS HC A04/MF A01

Second generation technologies were demonstrated. The economic, environmental and productive capacity of a near commercial-size plant were validated by integrating and operating a modular unit using commercial size equipment. These facilities were aimed at accelerating and reducing the risks of industrial process implementation. Contracts for the design, construction, and operation of the demonstration plants were awarded through competitive procedures and were cost shared with the industrial partner. The government share of the cost involved for a demonstration plant depends on the plant size, location, and the desirability and risk of the process to be demonstrated. The various plants and programs are discussed: description and status, funding, history, flowsheet and progress during the current quarter. DOE

N80-32556# Worcester Polytechnic Inst., Mass.

KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Jan. - Mar. 1980

Alvin H. Weiss, Wilmer L. Kranich, and Kemal Gueruez 20 Apr. 1980 29 p

(Contracts DE-AS01-77ET-10618)

(FE-2702-10) Avail: NTIS HC A03/MF A01

Delay in the delivery of a new pump prevented expansion of the range of flow rates already studied on lignite liquefaction in the continuous stirred tank reactor. Data previously reported have been refined and for the most part confirmed. Agitator speed does not affect reaction rate over the range of speeds used in experimental runs, but hydrogen pressure appears to exert an influence particularly at higher temperatures. A new batch reactor was put into operation which is expected to yield valuable catalyst screening and kinetic data. Successful design, fabrication, and operation of a fast-feed mechanism should greatly reduce the long preheating times which obscure the kinetic results of most batch studies. DOE

N80-32557# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.

ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1979

L. A. Salvador 25 Jan. 1980 74 p

(Contracts DE-AC01-76ET-10161; EF-77-C-01-1514)

(FE-1514-113; QPR-1) Avail: NTIS HC A04/MF A01

The results of gasification process development tests are reported. A review of the data and the effect of various modifications on cyclone deposits was conducted. It is tentatively concluded that the mechanism of deposit formation is the result of sticky particles or liquid droplets out of the combustion and/or gasification zone impacting on the hot refractory cyclone walls as a result of change in direction of flow. A water spray nozzle was installed in the freeboard area of the gasifier to quench particles with a liquid film and render them nonsticky. Water spray was also used to cool the gas and particles from 1800 F to 1300 F. At this temperature, the deposit was practically eliminated. However, long-duration tests with Pittsburgh seam and Ohio No. 9 coals are necessary before any firm conclusions can be drawn about the effect of water spray. Significant progress was made in the construction of the cold-flow, scale-up facility. In addition, studies were made on the reactivity of various chars in the laboratory fluidized bed. DOE

N80-32558# Montana State Univ., Bozeman. Dept. of Chemical Engineering.

CATALYTIC HYDROGENATION OF COAL-DERIVED LIQUIDS Progress Report, Dec. 1979 - Feb. 1980

Lloyd Berg and F. P. McCandless 28 Mar. 1980 30 p

(Contract DE-AC01-76ET-10495; EX-76-C-01-2034)

(FE-2034-18) Avail: NTIS HC A03/MF A01

The development of catalysts capable of converting solvent refined coal, SRC-2, into a feedstock suitable for a conventional petroleum refinery is assessed. A process which reduces the nitrogen content from the 1.17% in SRC-2 to at least as low as 0.3% is required. Four catalysts were fabricated and evaluated. A cobalt, molybdenum, nickel, tungsten metal loading was made on a molecular sieve base possessing 88.9A average pore diameter. It produced specification product before and after burnoff with air. Three cobalt molybdate catalysts of different metal loadings were fabricated on three different pore diameter bases, 88.9A, 156.5A, and 186.2A. DOE

N80-32559# Brookhaven National Lab., Upton, N. Y.
FUSION REACTORS FOR HYDROGEN PRODUCTION VIA ELECTROLYSIS
J. A. Fillo, J. R. Powell, and M. Steinberg 1979 7 p refs Presented at the 2d Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract DE-AC02-76CH-00016)
(BNL-27782; CONF-791204-37) Avail: NTIS HC A02/MF A01

The decreasing availability of fossil fuels emphasizes the need to develop systems which will produce synthetic fuel to substitute for and supplement the natural supply. An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of approximately 40 to 60% and hydrogen production efficiencies by high temperature electrolysis of approximately 50 to 70% and projected for fusion reactors using high temperature blankets. Doe

N80-32560# Sandia Labs., Albuquerque, N. Mex.
CATALYST CHARACTERIZATION IN COAL LIQUEFACTION Annual Report, 1 Oct. 1978 - 30 Sep. 1979
M. G. Thomas and D. G. Sample Jun. 1980 57 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0123) Avail: NTIS HC A04/MF A01

Neutron activation of American Cyanamid 1442A CoMo catalyst was employed to tag a one day's charge of catalyst in H-Coal PDU run no. 9. The activity of Co-60 in the withdrawals has shown that 8 days are required to uniformly distribute a daily addition of catalyst in the bed during PDU run no. 9. Catalysts used in the LC-Fining of SRC-1 show aging characteristics similar to H-Coal catalyst: 20 to 30 w/o organic contamination, 2 to 5 w/o inorganic contamination, 50 percent loss of surface area, and changes in pore volume distributions. Elemental distribution of contaminants indicate that the catalysts are extremely efficient metals scavengers, with titanium and iron major contaminants penetrating 200 micrometers into the catalysts. A mechanistic pathway for coal liquefaction were experimentally verified by the combination of low temperature (25 to 300 C) batch reaction data in inert atmospheres, high temperature-moderate pressure reaction data (500 psi H2) from tubing reactors at 400 and 426 C, and high pressure (2000 psi H2) data collected in a continuous reactor at 400, 425, and 450 C. DOE

N80-32561# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
BIOTECHNOLOGY FOR A RENEWABLE RESOURCES CHEMICALS AND FUELS INDUSTRY, BIOCHEMICAL ENGINEERING R AND D
Ruston H. Villet Apr. 1980 8 p refs Presented at 89th Ann. Meeting of AICE Portland, Oreg., 10-13 Aug. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-621-659; CONF-800802-4) Avail: NTIS HC A02/MF A01

An integration of research in biochemical engineering, microbial genetics, and biochemistry is required to establish an effective biotechnology of biomass processing for the production of fuels and chemicals. Reduction of the costs of producing chemicals and fuels from renewable resources will hinge on extensive research in biochemical engineering. DOE

N80-32562# Los Alamos Scientific Lab., N. Mex.
MICRO-LEVEL LAND USE IMPACTS OF BIOCONVERSION
Virginia Parsons 1980 6 p refs Presented at IASTED Energy Symp., Montreal, 28 May 1980
(Contract W-7405-eng-26)
(LA-UR-80-1426; CONF-800567-2) Avail: NTIS HC A02/MF A01

Local biomass potential, existing and use and potential land use impacts from bio-energy implementation for three of the fifteen counties selected for the TASE study are presented. The methodology created for the evaluation is useful in determining the biomass potential for any community or county, and in identifying regional differences inherent in the tradeoffs between existing land use and energy production. DOE

N80-32563# Dynatech R/D Co., Cambridge, Mass.
LIQUID FUELS PRODUCTION FROM BIOMASS Progress Report, 1 Jan. - 31 Mar. 1980
P. F. Levy, J. E. Sanderson, and D. L. Wise 31 Mar. 1980 48 p refs
(Contract EG-77-C-02-4388)
(COO-4388-11; Dynatech-2013; PR-11) Avail: NTIS HC A03/MF A01

It was found that marine algae could be converted to higher aliphatic organic acids and these acids can be converted to aliphatic hydrocarbons, which may be used as a diesel fuel. A coenzyme M analogue, 2-bromoethanesulfonic acid, was shown to be an effective suppressor of methane in nonsterile anaerobic fermentation of cellulosic substrates. An analysis of the energy outputs and requirements for the production of liquid hydrocarbon fuel from corn was performed. An analytical scheme for determining composition of biomass materials was devised. A tapered auger device was designed and built which was demonstrated on the bench to be effective for adding substrate and removing residue in a continuous manner from a fixed packed bed fermenter. A solvent extractor system using kerosene as the nonaqueous phase was constructed and is currently in operation in series with the 300 liter fixed packed bed fermenter. The electrolytic oxidation of organic acids produced in the 300 liter fixed packed bed fermenter is operating with a favorable energy balance of 6/1 based on the applied potential. DOE

N80-32564# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
CALIFORNIA'S BIOMASS AND ITS ENERGY POTENTIAL Ph.D. Thesis
Frank Bart Lucarelli, Jr. Apr. 1980 317 p refs
(Contract W-7405-eng-48)
(LBL-10058) Avail: NTIS HC A14/MF A01

Estimates of the costs of transforming biomass into different fuels as well as a survey of government's role in a biomass energy program are presented. The major findings are summarized below. (1) California's existing biomass resources are sufficient to provide only 20 percent of its future liquid fuel requirements. (2) Meeting the full transportation demand with biomass derived fuels will require the development of exotic biomass sources such as kelp farms and significant reduction in automobile travel in the State. (3) Under assumptions of moderate increases in gasoline prices and without major new government incentives, the cost of transforming biomass into transport fuels will be competitive with the price of gasoline on a Btu basis by the year 1990. (4) The environmental impacts of collecting most forms of biomass are beneficial and should reduce air pollution from agricultural burning and water pollution from feedlot and dairy farm runoff. DOE

N80-32565# California Univ., Livermore. Lawrence Livermore Lab.
USE OF AN AUTOMATED MASS SPECTROMETER FOR AN UNDERGROUND COAL GASIFICATION FIELD TEST
R. W. Crawford, R. G. Bedford, C. M. Wong, H. R. Brand, and K. I. Kishiyama Jul. 1980 29 p refs Presented at the Intern. Dyn. Mass Spectometry Symp., Canterbury, England, 7-10 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-84366; CONF-800732-1) Avail: NTIS HC A03/MF A01

A time-of-flight mass spectrometer was used to analyze the product gas from an underground coal gasification field experiment. It proved to be precise and moderately accurate. It was extremely stable and reliable. Its speed was more than adequate for most

requirements. The analysis of product gas was fully automated, but any other operation took manual intervention. DOE

N80-32568# California Univ., Livermore. Lawrence Livermore Lab.
ECONOMICS OF SHALE OIL PRODUCTION BY RADIO FREQUENCY HEATING
Richard G. Mallon 7 May 1980 11 p refs
(Contract W-7405-eng-48)
(UCRL-52942) Avail: NTIS HC A02/MF A01

A conceptual facility for the production of shale oil by radio frequency (rf) heating was designed to evaluate the economic feasibility of this technique. The shale was processed in situ without being rubbed or explosively fractured. Metal electrodes inserted in a set of vertical drill holes were energized by a group of rf oscillators. The electric field was developed in such a way that heating within the block was almost uniform, and heating outside the block was very low. The facility schedule is planned so that off-peak electric power from existing generating stations is used to operate the oscillators. The two principal costs are purchase of electric power and mining operations. The largest capital requirement is oscillators and associated electrical equipment. DOE

N80-32567# Institute of Gas Technology, Chicago, Ill.
SYNTHETIC FUELS FROM US OIL SHALES: A TECHNICAL AND ECONOMIC VERIFICATION OF THE HYTORT PROCESS Quarterly Report, 1 Jan. - 31 Mar. 1980
Jun. 1980 71 p ref
(Contract DE-AC01-79ET-14102)
(DOE/ET-14102-2) Avail: NTIS HC A04/MF A01

The technical and economic feasibility of the HYTORT process for both Eocene and Devonian shales was demonstrated. The program is divided into five major task areas: laboratory program; vench scale program; process development unit tests; process environmental assessment; and process design and economics. DOE

N80-32566# Gulf Research and Development Co., Pittsburgh, Pa.
INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION, PHASE 2 Annual Report, Jan. - Dec. 1978
D. C. Cronauer, R. O. Ruberto, and D. C. Young May 1979 110 p refs
(Contract EX-76-C-01-2305)
(FE-2305-30) Avail: NTIS HC A06/MF A01

An understanding of the mechanism of hydrogen transfer to coal and its intermediates during liquefaction was developed. Results of experiments with coal and asphaltenes are consistent with those of the model compounds, and the knowledge of both phases were combined. Coal primarily cracks in linkages between aromatic type units such that transferred hydrogen exists on carbons alpha to an aromatic ring. The coal free-radicals abstract hydrogen from any available source such as hydroaromatics, naphthenes, alkyl aromatics and dissolved hydrogen, in roughly that order. Solvent losses through adduction and isomerization were significant, and lead to decreased activity or effectiveness of recycled solvents. The use of nmr gives an improved understanding of the mechanism of reactions involved in the liquefaction of coal. DOE

N80-32569# Filtrol Corp., Los Angeles, Calif.
DEVELOPMENT OF NEW CATALYSTS FOR COAL LIQUID REFINING Quarterly Report, 1 Jan. - 31 Mar. 1980
Apr. 1980 28 p refs
(Contracts DE-AC01-78ET-12103; FT-78-C-01-2595)
(FE-2595-5; QR-5) Avail: NTIS HC A03/MF A01

The first series of cracking catalysts formulated with 20% exchanged Na-Y zeolite, and 80% matrix binder was activity tested with a hydrotreating SRC-2 Fuel Oil Blend. The best results were obtained with a rare earth exchanged zeolite. An improved catalyst for hydrotreating SRC-2 Fuel Oil Blend was prepared from a nickel molybdate impregnated Kaiser alumina. Synthesis and characterization of various catalytic components and cation exchange of these materials is complete. DOE

N80-32570# Brookhaven National Lab., Upton, N. Y.
ADVANCED SYNFUELS PRODUCTION/POWER SYSTEMS UTILIZING LASER PARTICULATE CONTROL
T. Botts, Jr., J. R. Powell, and J. A. Filio 1979 4 p refs
Presented at the 2d Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract DE-AC02-76CH-00016)
(BNL-27783; CONF-791204-38) Avail: NTIS HC A02/MF A01

Coal fired turbines offer an attractive means of generating electrical power using an available resource and near term technologies. However, in order to maintain adequate turbine blade lifetimes, and thus make such plants economically attractive, better means of hot gas clean up than those presently available are needed. One possible solution to this problem is the use of intense laser beams to augment the conventional body forces in cyclones to increase collector efficiencies for smaller sized particulates. Finally, plant factors can be increased by means of alternate energy utilization during offpeak periods. One such scheme is to raise steam and perform high temperature electrolysis. It appears as if the hydrogen produced is more useful as a transportable fuel or chemical than as a means of energy storage. DOE

N80-32571# New Zealand Energy Research and Development Committee, Auckland.
AUTOMOTIVE FUELS FROM CELLULOSE MATERIALS Final Report
B. Higginson and R. H. Thornton Jan. 1980 28 p refs
(NZERDC-49; ISSN-0110-1692) Avail: NTIS HC A03/MF A01

The results of this investigation showed that it was feasible to link the alcohol fermentation and anaerobic digestion processes into a system for the production of both alcohol and methane from organic substrates. Although optimization of fermentation was attempted with due regard to energy conservation, for industrial application the cost of sugar will be the overriding factor. A hydraulic retention time of 10 days or longer was needed for effective digestion in which a reduction of chemical oxygen demand of up to 85% was achieved. Results indicated that further reduction in retention time may be possible if the microbial biomass could be either retained on support media, or recycled more effectively. A gas production rate of 4270 liters gas/cubic meter culture/day at 11.6 day retention time was obtained with the anaerobic contact digester using fodder beet spent wash. Using the same substrate, results over short periods with the anaerobic filter system could produce up to 4.8 liters gas/litre culture/day. The high methane composition of this gas (75 to 80%) make this an attractive proposition. DOE

N80-32572# Mechanical Technology, Inc., Latham, N. Y.
ASSESSMENT OF SYNTHANE MECHANICAL EQUIPMENT
J. T. McCabe, F. E. Kramberger, B. R. Hao, D. Dubis, and S. E. Carson May 1980 164 p refs
(Contract DE-AC01-77ET-10622)
(MTI-79TR5) Avail: NTIS HC A08/MF A01

Mechanical equipment in the Synthane pilot plant was subjected to operating conditions outside manufacturers' specifications. In some cases, these encounters were intentional and in other cases they resulted from insufficient data. All 106 of the test runs were terminated involuntarily. For the most part, the repetitive failures of plant materials and equipment originated from a combination of excessive solids overloading and corrosion/erosion caused by abnormal conditions of operation on fluid process streams. The extremes of these conditions were not anticipated nor were they taken into consideration in the design of the plant and in the selection of equipment and materials. Because of this situation, approximately half of the test run terminations were directly attributed to mechanical failures. Generally, for reasons given the maintenance, repair or replacement of failed equipment was not successful in eliminating or alleviating many failures until early 1978. Appropriate early planning can eliminate all these causes of failure in the future. DOE

N80-32573# Los Alamos Scientific Lab., N. Mex.
FLASH PYROLYSIS AND GASIFICATION OF COAL THROUGH LASER HEATING

W. H. Beattie and J. A. Sullivan 1980 6 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1094; CONF-800806-28) Avail: NTIS HC A02/MF A01

Experimental results obtained from the rapid pyrolysis of finely powdered coal are presented. The experiments are designed to provide basic information on gas yield, gas composition, optimum fluxes, and temperature history of coal samples under high intensity laser radiation. The information obtained from these experiments is used to test concepts for the use of concentrated sunlight to produce fuel gases from coal. Heating the coal at rates of 1000 to 10,000 C/s in an inert atmosphere of argon results in pyrolysis at temperatures between 400 and 800 deg C. The gases evolved are primarily CO, H2, and CH4 with lesser amounts of CO2 and other light hydrocarbons. Mass spectrometry is used to determine the composition of the evolved gases. The optimum flux for laser pyrolysis of coal was found to be 250w /sq cm. Results from experiments wherein the char created by pyrolysis is gasified to CO in an atmosphere of CO2 are also presented. DOE

N80-32574# Pace Co. Consultants and Engineers, Inc., Denver, Colo. Div. of Coal Conversion.
COAL LIQUEFACTION Quarterly Report, Apr. - Jun. 1979
Apr. 1980 65 p
(DOE/FE-0003/79-2) Avail: NTIS HC A04/MF A01

Current work is aimed at improved process configurations for both catalytic and non catalytic processes to provide more attractive processing economics and lower capital investment. The advantage of coal liquefaction is that the entire range of liquid products, especially boiler fuel, distillate fuel oil, and gasoline, can be produced from coal by varying the type of process and operating conditions used in the process. Furthermore coal derived liquids have the potential for use as chemical feedstocks. To provide efficient and practical means of utilizing, coal resources, DOE is supporting the development of several conversion processes that are currently in the pilot plant stage. DOE

N80-32575# Maryland Univ., College Park. Dept. of Mechanical Engineering.
THERMODYNAMIC PROPERTIES OF LIQUEFIED PETROLEUM GASES (LPG) Interim Report, 15 Aug. 1975 - 31 Jan. 1977
Dirse W. Sallet and K. F. Wu Apr. 1980 111 p refs
(Contract DOT-FR-64181)
(PB80-189053; FRA/ORD-76/299) Avail: NTIS HC A06/MF A01 CSCL 21D

The thermodynamic properties of several liquefied petroleum gases (with particular emphasis on propane) are discussed in detail. Thermodynamic data for four liquefied petroleum gases were calculated and are presented in tabular form. Predictors of pure propane mass flow rates (based upon isentropic) homogeneous equilibrium flow are given. The influence of the thermodynamic data upon the predicted mass flow rates was demonstrated. GRA

N80-32576# Maryland Univ., College Park. Dept. of Mechanical Engineering.
THE CALCULATION OF THE THERMODYNAMIC PROPERTIES OF PROPANE, PROPYLENE, N-BUTANE, AND ETHYLENE Final Report, 31 Jan. 1977 - 31 May 1978
Dirse W. Sallet and Milton E. Palmer Apr. 1980 167 p refs
(Contract DOT-FR-64181)
(PB80-189061; FRA/ORD-76/300) Avail: NTIS HC A08/MF A01

The thermodynamic properties of propane, propylene, n-butane and ethylene were calculated and are presented in tables. The tables list the values of the specific volume, the enthalpy, the entropy, the specific heat at constant pressure, the specific heat at constant volume and the sonic velocity of the four hydrocarbons in a temperature and pressure range which can be encountered when these commodities are shipped by rail tank cars. This includes subcooled states, saturation equilibrium states and superheated states. The computer program with which the tables were generated is discussed in detail and a complete listing of the program is given. GRA

N80-32577# Radian Corp., Austin, Tex.
QUANTITATIVE ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS IN LIQUID FUELS Final Report, Oct. 1976 - Oct. 1978
Jerry L. Parr Apr. 1980 44 p refs
(Contract EPA-68-02-2466)
(PB80-187388; EPA-600/2-80-069) Avail: NTIS HC A03/MF A01 CSCL 21D

A quantitative analysis of 12 individual polynuclear aromatic hydrocarbons (PNAs) present in various aircraft turbine, diesel, and gasoline test fuels was determined. The fuel samples were analyzed by combined gas chromatography/mass spectrometry (GC-MS) after a preliminary isolation/concentration scheme. Liquid crystal chromatographic columns were employed to resolve isometric PNAs. GRA

N80-32578*# New Mexico Univ., Albuquerque. Technology Application Center.
BIOMASS ENERGY PRODUCTION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Apr. 1980
Peter W. Moore Jun. 1980 58 p Sponsored in cooperation with NASA and NTIS
(PB80-810807; NASA-CR-163595) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

These 210 citations from the international literature describe the production and/or utilization of most forms of biomass as a source of energy, fuel, food, and chemical intermediates or feedstocks. Biomass conversion by incineration, gasification, pyrolysis, hydrolysis, anaerobic digestion, or fermentation, as well as by catalytic, photosynthetic, chemosynthetic, and bio-electrochemical means are among the conversion processes considered. Discussions include biomass plantation and material productivity, transportation and equipment requirements, effects, comparisons of means and efficiencies of utilization and conversion, assessments of limitations, and evaluations of economic potential. GRA

N80-32579# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL AND AGRICULTURAL WASTES. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1978 - Apr. 1980
Audrey S. Hundemann Jul. 1980 165 p Supersedes NTIS/PS-79/0547; NTIS/PS-78/0500
(PB80-812365; NTIS/PS-79/0547; NTIS/PS-78/0500) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography cites worldwide literature on the production of fuels from waste materials, such as animal manure, wood chips,sewage sludge, urban garbage, agricultural wastes, and old automobiles. This updated bibliography contains 159 citations, 57 of which are new entries to the previous edition. GRA

N80-32580# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 256 p Supersedes NTIS/PS-79/0713; NTIS/PS-78/0673
(PB80-812431; NTIS/PS-79/0713; NTIS/PS-78/0673) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography covers Federally funded research on alcohol based fuels that may be used in the future as a fuel source. The citations cover synthesis, chemical analysis, performance testing, processing, pollution economics, environmental effects, and feasibilty. This updated bibliography contains 245 citations, 110 of which are new entries to the previous edition. GRA

N80-32581# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1978
Diane M. Cavagnaro Jun. 1980 227 p
(PB80-812449) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports from a worldwide literature survey,

includes such topics as blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. Also covered are the sources from which alcohol fuels can be obtained, such as coal, solid wastes industry byproducts, and agricultural waste. This updated bibliography contains 220 citations, none of which are new entries to the previous edition. GRA

N80-32582# National Technical Information Service, Springfield, Va.
ALCOHOL FUELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 163 p Supersedes NTIS/PS-79/0714; NTIS/PS-78/0674
(PB80-812456; NTIS/PS-79/0714; NTIS/PS-78/0674) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports from a worldwide literature survey discuss new technology in the field of alcohol fuels. The bibliography covers the different blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. The research also covers sources from which alcohol fuels can be obtained, such as coal, solid wastes, industrial by-products and agricultural wastes. This updated bibliography contains 156 citations, 21 of whch are new entries to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-32583* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR SUPPLYING CONDITIONED AIR AT A SUBSTANTIALLY CONSTANT TEMPERATURE AND HUMIDITY Patent
Henry D. Obler, inventor (to NASA) Issued 1 Jul. 1980 9 p Filed 6 Feb. 1979 Supersedes N79-19688 (17 - 10, p 1331)
(NASA-Case-GSC-12191-1; US-Patent-4,210,278; US-Patent-Appl-SN-009886; US-Patent-Class-236-49; US-Patent-Class-236-13; US-Patent-Class-236-44C; US-Patent-Class-165-16) Avail: US Patent and Trademark Office CSCL 13B

The apparatus includes a supply duct coupled to a source of supply air for carrying the supply air therethrough. A return duct is coupled to the supply duct for carrying return conditioned air therethrough. A temperature reducing device is coupled to the supply duct for decreasing the temperature of the supply and return conditioned air. A by-pass duct is coupled to the supply duct for selectively directing portions of the supply and return conditioned air around the temperature reducing device. Another by-pass duct is coupled to the return duct for selectively directing portions of the return conditioned air around the supply duct and the temperature reduction device. Controller devices selectively control the flow and amount of mixing of the supply and return conditioned air.

Official Gazette of the U.S. Patent and Trademark Office

N80-32584* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR PLOTTING SUBSOIL STRUCTURE AND METHOD THEREFOR Patent
Keshavaiyengar Y. Narasimhan (JPL), Robert Nathan (JPL), and Shakkottai P. Parthasarathy, inventors (to NASA) (JPL) Issued 22 Jul. 1980 8 p Filed 6 Sep. 1977 Supersedes N79-20555 (17 - 11, p 1455) Sponsored by NASA
(NASA-Case-NPO-14191-1; US-Patent-4,214,226; US-Patent-Appl-SN-830846; US-Patent-Class-367-27; US-Patent-Class-181-102; US-Patent-Class-367-36; US-Patent-Class-367-57) Avail: US Patent and Trademark Office CSCL 08M

Data for use in producing a tomograph of subsoil structure between boreholes is derived by pacing spaced geophones in one borehole, on the Earth surface if desired, and by producing a sequence of shots at spaced apart locations in the other borehole. The signals, detected by each of the geophones from the various shots, are processed either on a time of arrival basis, or on the basis of signal amplitude, to provide information of the characteristics of a large number of incremental areas between the boreholes. Such information is useable to produce a tomograph of the subsoil structure between the boreholes. By processing signals of relatively high frequencies, e.g., up to 100 Hz, and by closely spacing the geophones, a high resolution tomograph can be produced.

Official Gazette of the U.S. Patent and Trademark Office

N80-32585*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LIQUID IMMERSION APPARATUS FOR MINUTE ARTICLES Patent Application
Jewell G. Belcher and Ben R. Hollis, inventors (to NASA) Filed 18 Jul. 1980 9 p
(NASA-Case-MFS-25363-1; US-Patent-Appl-SN-171933) Avail: NTIS HC A02/MF A01 CSCL 13H

An apparatus for immersing minute articles such as integrated circuit chip in an etching solution during manufacture of the chips is described. The apparatus includes a basket having minute fluid passages in its sides and bottom, the passages being dimensioned to overcome buoyancy while allowing complete circulation. The basket has a removable lid member also having fluid passages to prevent air pockets and facilitate circulation. Both the basket and lid member are constructed of corrosion resistant material such as Teflon and are dimensional to provide a friction bit. A holder member including handle portion and support mean is disposed to support and retain the basket while in the solution. The overall combination of the basket, lid, and handle having the features referred to above enable treatment of the chips and avoidance of losses and unnecessary handling. E.D.K.

N80-32586*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Development Dept.
PROJECT FIRES. VOLUME 2: PROTECTIVE ENSEMBLE PERFORMANCE STANDARDS, PHASE 1B Final Contractor Report
Fred J. Abeles May 1980 140 p refs
(Contract NAS8-32329)
(NASA-CR-161530) Avail: NTIS HC A07/MF A01 CSCL 13B

The design of the prototype protective ensemble was finalized. Prototype ensembles were fabricated and then subjected to a series of qualification tests which were based upon the protective ensemble performance standards PEPS requirements. Engineering drawings and purchase specifications were prepared for the new protective ensemble. A.R.H.

N80-32587*# Notre Dame Univ., Ind.
COUPLED WAVE MODEL FOR LARGE MAGNET COILS Final Report
G. J. Gabriel Sep. 1980 53 p refs
(Grant NsG-3182)
(NASA-CR-3332; E-535) Avail: NTIS HC A04/MF A01 CSCL 09C

A wave coupled model based on field theory is evolved for analysis of fast electromagnetic transients on superconducting coils. It is expected to play a useful role in the design of protection methods against damage due to high voltages or any adverse effects that might arise from unintentional transients. The significant parameters of the coil are identified to be the turn to turn wave coupling coefficients and the travel time of an electromagnetic disturbance around a single turn. Unlike circuit theoretic inductor, the coil response evolves in discrete steps having durations equal to this travel time. It is during such intervals that high voltages are likely to occur. The model also bridges the gap between the low and high ends of the frequency spectrum. Author

N80-32588# Nottingham Univ. (England). Dept. of Civil Engineering.
PERMANENT DEFORMATION OF FLEXIBLE PAVEMENTS Final Technical Report, Sep. 1978 - Jun. 1980
S. F. Brown, B. V. Broderick, and J. W. Pappin Jun. 1980 165 p refs
(Grants DA-ERO-78-G-114; DA-ERO-77-G-061;

DA Proj. 1T1-61102-BH-57)
(AD-A087859) Avail: NTIS HC A08/MF A01 CSCL 13/2

Seven pairs of pavements with granular bases were tested under controlled conditions. One pavement in each pair contained fabric inclusions. An improved testing facility was developed, including: (1) servo-hydraulic system for the loading carriage; (2) amplification and read-out system for pressure cells; (3) linearizing unit for strain coils; (4) transducers for measuring vertical and resilient deflection; (5) techniques for measuring in situ strain on fabric inclusions; (6) extensive use of nuclear density meter to monitor pavement and foundation materials. The following conclusions are drawn: (1) No improvement in performance resulted from fabric inclusions. (2) No consistent reduction in in-situ stresses, resilient strains, or permanent strains was observed as a result of fabric inclusion. (3) No consistent improvement in densities resulted from fabric inclusions. (4) Some slip apparently occurred between fabric and soil on those pavements which involved large deformations. The slip occurred between fabric and crushed limestone base rather than between fabric and silty-clay subgrade. GRA

N80-32589# Stanford Univ., Calif. Physics Labs.
ACOUSTIC MICROSCOPY AT CRYOGENIC TEMPERATURES Annual Summary Report, 1 Jul. 1979 - 30 Jun. 1980
C. F. Quate and J. Heiserman Jul. 1980 28 p refs
(Contract N00014-77-C-0412; NR Proj. 384-924)
(AD-A087677; SU-GL-3149) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report summarizes our progress in development of high resolution acoustic microscopes for use at cryogenic temperatures. During the past year we have concentrated on development of efficient acoustic matching layers for use in liquid helium and extension of our techniques to temperatures below 0.5 K in liquid helium. As a first step at these low temperatures, we have begun probing the acoustic properties of the liquid at frequencies at least 5 times higher than previously published results. GRA

N80-32590# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MATHEMATICAL MODEL TO CORRELATE FROST HEAVE OF PAVEMENTS WITH LABORATORY
R. L. Berg, G. L. Guymon (California Univ., Irvine), and T. C. Johnson Feb 1980 56 p refs Sponsored in part by FAA and Federal Highway Administration
(DA Proj. 4A7-62730-AT-42)
(AD-A084737; CRREL-80-10) Avail: NTIS HC A04/MF A01 CSCL 08/12

A mathematical model of coupled heat and moisture flow in soils was developed. The model includes algorithms for phase change of soil moisture and frost heave and permits several types of boundary and initial conditions. The finite element method for weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially decoupled; moisture flux was simulated accurately, as were heat flux and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrate the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave. The algorithm incorporating effects of surcharge and overburn was inconclusively evaluated. Time-dependent frost penetration and frost heave in laboratory specimens were closely simulated with the model. L.F.M.

N80-32591# Hughes Helicopters, Culver City, Calif.
CONVENTIONAL MACHINING OF ESR 4340 STEEL Final Report, 1 Sep. 1978 - 1 Apr. 1980
K. K. Nip Jul. 1980 118 p
(Contract DAAG46-78-C-0046)
(AD-A088451; HH-80-125; USAAVRADCOM-TR-80-F-14; AMMRC-TR-80-34) Avail: NTIS HC A06/MF A01 CSCL 13/8

This program involved the study of conventional machining of heat treated ESR 4340 steel (Rc 54-57). Initial effort involved a survey of available data regarding the machining of high strength steels with hardnesses of Rc 50 and above. A machining program was conducted, determining optimum tools and conditions for turning, drilling, face milling, end milling, and grinding operations. Effects of various parameters including cutting speeds, feeds, depths of cut, and cutting fluids on tool life was determined. All the operations were found to be extremely difficult and application of conventional procedures is not feasible. Tool lives remained short despite reductions in speeds and feeds. Conventional grinding methods induced detrimental residual tensile stresses along the surface, resulting in cracking, lapping, and untempered martensitic structures. Low stress grinding techniques were found to be applicable to this material when proper dressing procedures and reduced rates were used. GRA

N80-32592# Mantle Engineering Co., Inc., Alexandria, Va.
AIR CUSHION CRAFT DEVELOPMENT, FIRST REVISION Final Report
Peter J. Mantle Jan. 1980 525 p refs
(AD-A084740; DTNSRDC-80/012-Rev-1) Avail: NTIS HC A22/MF A01 CSCL 13/10

The development of air cushion craft from their inception to the present day is described. Both aerostatic craft known as air cushion vehicles and surface effect ships as well as aerodynamic craft such as wing-in-ground effect vehicles are covered. The various available theories, empirical laws, and experimental data were brought together and expressed in unified form. Emphasis is given to reducing the data and analysis to their simplest forms for easy understanding and isolation of fundamental parameters. Currently operational craft, those still in their construction jigs, or in some cases those still on the drawing board are assessed and compared to the basic theories to give a measure of the state-of-the-art. Such topics as performance, propulsion, ride quality, and high speed aerodynamic craft are included. R.K.G.

N80-32593# United Technologies Corp., East Hartford, Conn.
ANALYTICAL MODELING OF THE HOT ISOSTATIC PRESSING PROCESS Final Report, 15 Jul. 1978 - 14 Jul. 1980
Brice N. Cassenti and K. J. Cheverton Jul. 1980 134 p refs
(Contract F49620-78-C-0090; AF Proj. 2307)
(AD-A088208; R80-944374-13; AFOSR-80-0592TR) Avail: NTIS HC A07/MF A01 CSCL 13/8

This report describes the results of a two-year investigation to develop a modeling strategy to predict the final shape of components manufactured by the Hot Isostatic Pressing (HIP) process. When a powder metal is subjected to the high pressures at high temperatures there is a permanent reduction in the macroscopic volume by approximately 30 percent. The volume reduction, which is not included in classical creep and plasticity theories, necessitates the modification of the classical theories. The major part of this report concerns development of a constitutive model for powder metals. A model for powder metals subjected to an external hydrostatic pressure has been developed and compares well with experimental results. The exact form of the theory for a multi-axial stress state was determined by a series of mechanical tests. The constitutive model has been incorporated into the MACR nonlinear finite element computer program and analysis of an independent experiment using the modified code has been performed and verified the accuracy of the theory. Once the theory had been verified it was applied to the HIP of a disk and a sensitivity study was performed to determine an efficient modeling strategy. The results of the program are discussed in detail. GRA

N80-32594# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MATHEMATICAL MODEL TO CORRELATE FROST HEAVE OF PAVEMENTS WITH LABORATORY PREDICTIONS Final Report
Richard L. Berg, Gary L. Guymon, and Thaddeus C. Johnson Mar. 1980 54 p refs Sponsored by FAA
(AD-A084093; FAA-RD-79-109) Avail: NTIS HC A04/MF A01 CSCL 08/12

A mathematical model of coupled heat and moisture in soils was developed. The model includes algorithms for phase change of soil moisture and frost heave, and several types of boundary

and initial conditions are permitted. The finite element method of weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime and the Crank-Nicholson method was used for the time domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially 'decoupled'; moisture flux was then simulated accurately, as were heat flux and frost penetration. The coupled model was used to simulate frost penetration and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave.
Author

N80-32595# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
EFFECTS OF ENERGY-EFFICIENT VENTILATION RATES ON INDOOR AIR QUALITY AT AN OHIO ELEMENTARY SCHOOL
J. V. Berk, R. Young, C. D. Hollowell, I. Turiel, and J. Pepper Apr. 1980 68 p refs
(Contract W-7405-eng-48)
(LBL-10223; EEB-Vent-80-9) Avail: NTIS HC A04/MF A01

A mobile laboratory was used to monitor air outdoors and at three indoor sites (two classrooms and a large multipurpose room); tests were made at three different ventilation rates. The parameters measured were outside air flow rates, odor perception, microbial burden, particulate mass, total aldehydes, carbon dioxide, ozone, and nitrogen oxides. The results of these measurements are given and compared with the existing outdoor air quality standards. Carbon dioxide concentrations increased as the ventilation rate decreased, but still did not exceed current standards. Odor perceptability increased slightly at the lowest ventilation rate. Other pollutants showed very low concentrations, which did not change with reductions in ventilation rate. DOE

N80-32596# Los Alamos Scientific Lab., N. Mex.
MAGNETIC REFRIGERATION FOR SPACE APPLICATIONS
J. A. Barclay and W. A. Steyert 1980 6 p refs Presented at the 8th Intern. Cryog. Eng. Conf. Genoa, 3 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1566; CONF-800631-7) Avail: NTIS HC A02/MF A01

Magnetic refrigeration is briefly analyzed and thermodynamically compared to gas refrigeration. The characteristics of magnetic refrigerators with respect to spacecraft applications are discussed. High reliability coupled with high efficiency is possible. Results on several wheel and reciprocating magnetic refrigerators are summarized. DOE

N80-32597# Idaho National Engineering Lab., Idaho Falls.
EXPLOSIVE DEMOLITION OF ACTIVATED CONCRETE
D. L. Smith 1980 16 p Presented at the Concrete Decontamination Workshop, Seattle, 28 May 1980
(Contract DE-AC07-76ID-01570)
(CONF-800542-4) Avail: NTIS HC A02/MF A01

This paper describes the removal of a radiologically contaminated concrete pad. This pad was removed during 1979 by operating personnel under the direction of the Waste Management Program of EG and G Idaho, Inc. The concrete pad was the foundation for the Organic Moderated Reactor Experiment (OMRE) reactor vessel. The pad consisted of a cylindrical concrete slab 15 ft in diameter, 2 ft thick, and reinforced with steel bar. It was poured directly onto basalt rocks approximately 20 ft below grade. The entire pad contained induced radioactivity and was therefore demolished, boxed, and buried rather than being decontaminated. The pad was demolished by explosive blasting. DOE

N80-32598# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Physics.
THERMODYNAMIC PROPERTIES OF SOLID HELIUM USING AN ANHARMONIC ANISOTROPIC CONTINUUM MODEL Ph.D. Thesis
Terrell Dunlap Berker 1980 106 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1314) Avail: NTIS HC A06/MF A01

An anharmonic anisotropic continuum model is used to describe the thermodynamic properties of solid helium for all three structures (hcp, fcc, and bcc) and both isotopes. Using a 6-n potential with the de Boer value for the attractive parameter, the two repulsive paramsters b sub n and n are varied to obtain a best fit to experimental hcp HE4 data. The n = 11 potential gives good volume dependence over the entire experimentally accessible volume range, but too large an isotope effect. The n = 10 potential gives a better mass dependence, but a less satisfactory volume dependence. A detailed comparison of the calculations with experimental data shows that while it is possible to fit the volume dependence of the pressure, bulk modulus, and Debye temperature over a very wide range, the model overestimates the zero point contribution to the free energy. The conclusion is reached that the major discrepancies obtained result from the failure of the continuum model to take account of dispersion. This failure can be remedied by artifically endowing the continuum with dispersion. A program for the further development of the model is outlined. DOE

N80-32599# Bendix Corp., Kansas City, Mo.
METROLOGY DATA REDUCTION SYSTEM: PDP-11/34 COMPUTER SYSTEM
J. W. Cable Apr. 1980 48 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2402) Avail: NTIS HC A03/MF A01

A PDP 11/34 computer system was installed to acquire, correct, scale, display, store, and process data obtained by microwave and dc area coupler controllers. The system is used to calibrate power sensors and impedance and dc measurement standards on a real time basis. The microwave data input is from a digital voltmeter and scanner arrangement, which also may be controlled from a P-ROM control board. The dc data input is from a passive device interface or from a terminal keyboard. DOE

N80-32600# Virginia Highway and Transportation Research Council, Charlottesville.
INVESTIGATION OF FATIGUE FAILURE IN BITUMINOUS BASE MIXES Final Report
G. W. Maupin, Jr. Feb. 1980 27 p refs
(PB80-188006; VHTRC-80-R36; FHWA/VA-80/36) Avail: NTIS HC A03/MF A01 CSCL 13D

A correlation between the results obtained with the fatigue test and those from the indirect tensile test on two base mixes was attempted in anticipation of the possible use of the latter test to design base mixes for maximum fatigue life. Two base mixes at several asphalt contents were tested at two test temperatures. Flexural fatigue tests and indirect tensile tests were performed for each mix and temperature condition. The asphalt content corresponding to the maximum fatigue life agreed generally with the asphalt content corresponding to maximum work in the indirect tensile test. The work computed from the indirect tensile test is useful in selecting the asphalt content for the maximum fatigue life of base mixes. GRA

N80-32601# Bjorksten Research Labs., Inc., Madison, Wis.
ALTERNATIVE HIGHWAY DEICING CHEMICALS, EXECUTIVE SUMMARY Final Report, Jul. 1976 - Oct. 1979
Stanley A. Dunn and Roy U. Schenk Mar. 1980 20 p refs
(Contract DOT-FH-11-9100)
(PB80-193634; FHWA/RD-79/109) Avail: NTIS HC A02/MF A01 CSCL 13B

A search was made for road deicing chemicals to replace sodium chloride (NaCl). Two candidate deicers were found to be as effective as sodium chloride. One, methanol, reacts almost immediately upon contact with snow and ice but is less persistent than NaCl. The other calcium magnesium acetate (CMA), acts at about the same rate as NaCl in the temperature range of common activity and shows about the same persistence. It gives rise to about the same decreases in coefficients of braking traction and skidding friction as NaCl. CMA is a corrosion inhibitor, is beneficial to most soils and has no potential for harming drinking supplies. The unpurified CMA derived from solid wastes, primarily cellulose, gives improved traction and reduces production costs. GRA

N80-32602# Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
THE EFFECT OF COMPACTED PRESTRESS ON COMPACTED SHALE COMPRESSIBILITY Interim Report
G. R. Witzman and C. W. Lovell 5 Sep. 1979 199 p refs Sponsored by Indiana State Highway Commission
(PB80-191158; JHRP-79-16; FHWA/IN/JHRP-79/16; IR-6) Avail: NTIS HC A09/MF A01 CSCL 08M

The compressibility of the compacted New Providence Shale was studied as a function of the compaction variables, viz., water content, compactive foot pressure, compaction effort, and compacted density. All samples were compacted in the kneading device to simulate low, standard and modified impact energy levels. All compression and/or heave was one dimensional. Compactive prestress was found to increase with compaction pressure and to decrease with compaction water content. To simulate the effects of the service environment, compacted samples were confined and saturated with measurements, of volume change. Such changes were either increases (heave) or decreases (settlement or collapse). The prediction equations developed are of the type needed to predict settlement of heaves within compacted shale embankments in service. GRA

N80-32603# Texas Transportation Inst., College Station.
PAVEMENT AND GEOMETRIC DESIGN CRITERIA FOR MINIMIZING HYDROPLANING. A TECHNICAL SUMMARY Final Report
B. M. Galloway, G. G. Hayes, D. L. Ivey, W. B. Ledbetter, R. M. Olson, H. E. Ross, Jr., R. E. Schiller, Jr., and D. L. Woods Dec. 1979 111 p refs
(Contract DOT-FH-11-8269)
(PB80-190457; FHWA/RD-79/30) Avail: NTIS HC A06/MF A01 CSCL 13B

The empirical indications of hydroplaning as determined from hard data were covered. Precise measurements of surface drainage were examined, and equations relating pavement texture and cross slope and rainfall intensity were developed. Vehicle control as related to variation in cross slope was simulated with the HVOSM simulation model. A determination of the deficiencies in existing surface drainage design methodology for sag vertical curves was conducted, and innovative solutions to these problems are presented. From a detailed study of state rainfall records a method is presented for determining a design rainfall intensity. Field studies of open graded friction courses included water depths in simulated and natural rainfall, the effects of tire type, tread depth, inflation pressure, vehicle speed, and accumulated traffic. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-32604* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTIPLE BAND CIRCULARLY POLARIZED MICROSTRIP ANTENNA Patent
I-Ping Yu, inventor (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 19 Aug. 1980 7 p Filed 22 Jun. 1979 Supersedes N79-27348 (17 - 18, p 2393 Sponsored by NASA
(NASA-Case-MSC-18334-1; US-Patent-4,218,682; US-Patent-Appl-SN-051270; US-Patent-Class-343-700MS; US-Patent-Class-343-830) Avail: US Patent and Trademark Office CSCL 09C

A multiple antenna assembly for communicating electromagnetic radiation is disclosed. An antenna element stack is constructed of a plurality of elliptical lamina antenna elements mutally separated by layers of dielectric material, and separated from a ground plane by dielectric material. The antenna assembly is coupled through a feed line in contact with the top antenna element. A conductor joins the remaining antenna elements to the ground plane. Each individual antenna element is operable for communication reception and transmission within a frequency band determined by the size of the particular antenna element. The sizes of the antenna elements may be selected to provide electromagnetic radiation communication over several distinct frequency bands, or to connect the individual bands into a broad band.

Official Gazette of the U.S. Patent and Tradmark Office.

N80-32605* National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPPORT ASSEMBLY FOR CRYOGENICALLY COOLABLE LOW-NOISE CHOKE WAVEGUIDE Patent
Frank E. McCrea, inventor (to NASA) (JPL) Issued 29 Jul. 1980 5 p Filed 31 Aug. 1978 Supersedes N79-10246 (17 - 01, p 0033) Sponsored by NASA
(NASA-Case-NPO-14253-1; NASA-Case-NPO-14640-1; US-Patent-4,215,327; US-Patent-Appl-SN-938293; US-Patent-Class-333-252; US-Patent-Class-333-12; US-Patent-Class-333-99S) Avail: US Patent and Trademark Office CSCL 09C

A compact cryogenically coolable choked waveguide for low-noise input coupling into a cryogenically cooled device, such as a maser or parametric amplifier, utilizes coaxial stainless steel support tubes surrounding the waveguide and connected in cascade to provide a folded low thermal conduction path. The edges of the tubes connected are welded.

Official Gazette of the U.S. Patent and Trademark Office

N80-32606 British Library Lending Div., Boston Spa (England).
TRANSMISSION OF 565 Mbit/s SIGNALS VIA COAXIAL CABLES
Helmut Bauch, Hans G. Jungmeister, and Karl Heinz Moehrmann Jan. 1980 14 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (West Germany), v. 32, no. 9, 1979 p 608-612
(BLL-RDL-Trans-3793-(7737.470)) Avail: British Library Lending Div., Boston Spa, Engl.

A high bit rate transmission system which utilizes coaxial cables is described. In this installation the intermediate regenerators are operated parallel to the previously introduced repeaters of a 60 MHz CF system. The 60 MHz system on the coaxial pair 2.6/9.5 mm has a nominal repeater spacing of 1.55 km. The 60 MHz repeaters and the 565 Mbit/s intermediate regenerators can be accommodated together in the same underground container because they have the same maximum and minimum repeater spacing temperature range and method of connection and also comparable external dimensions. The power loss of the regenerators constructed is only about 3 W per direction; this is the same as the power loss of the repeaters of the 60 MHz system, thereby allowing the same remote power feeding distance to be obtained. The underground regenerators, line terminal devices, and fault locating equipment required for the experimental system are described. M.G.

N80-32607*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTIBEAM SINGLE FREQUENCY SYNTHETIC APERTURE RADAR PROCESSOR FOR IMAGING SEPARATE RANGE SWATHS Patent Application
Atul Jain, inventor (to NASA) (JPL) Filed 3 Jul. 1980 21 p (Contract NAS7-100)
(NASA-Case-NPO-14525-2; US-Patent-Appl-SN-165910) Avail: NTIS HC A02/MF A01 CSCL 20E

A single-frequency multibeam synthetic aperture radar for large swath imaging is disclosed. Each beam illuminates a separate 'footprint' (i.e., range and azimuth interval). The distinct azimuth intervals for the separate beams produce a distinct Doppler frequency spectrum for each beam. After range correlation of raw data, an optical processor develops image data for the different beams by spatially separating the beams to place each beam of different Doppler frequency spectrum in a different location in the frequency plane as well as the imaging plane of the optical processor. Selection of a beam for imaging is made in the frequency plane by adjusting the position of an aperture, or in the image plane by adjusting the position of a slit. The raw data is processed in digital form in an analogous manner. NASA

N80-32608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED COMMUNICATIONS SATELLITES

Joseph N. Sivo Washington 1980 19 p refs Presented at the Ann. Meeting of AAS and AIAA, Boston, 20-23 Oct. 1980
(NASA-TM-81599; E-585) Avail: NTIS HC A02/MF A01 CSCL 17B

The increase in demand for satellite communications services brought about shortages in available transponder capacity, especially at C-band. Interest shifted to the Ku-band frequency and currently carriers are rapidly moving to secure orbital slots for future satellite development. Projections of communications service demands over the next decade indiate growth in voice, data, and video services such that saturation of both C-band and Ku-band will occur by 1990. Emphasis must and will shift to Ka-band (20/30 GHz) frequency for fixed-satellite service. Advanced technologies such as multibeam antennas coupled with on-board satellite switching to allow implementation in this band of very high capacity satellite systems will be applied to meet the demand. Satellite system concepts that are likely in the 1990's and are likely to bring a new dimension to satellite delivered communication service are presented. The NASA 30/20 GHz communications satellite system demonstration program is discussed with emphasis on the related technology development. L.F.M.

N80-32609*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A BOUNDS ON THE RESONANT FREQUENCY OF RECTANGULAR MICROSTRIP ANTENNAS
M. C. Bailey Sep. 1980 18 p refs
(NASA-TM-81882) Avail: NTIS HC A02/MF A01 CSCL 20M

The calculation of currents induced by a transverse electric plane wave normally incident upon an infinite strip embedded in a grounded dielectric slab is used to infer a lower bound on the resonant frequency (or resonant-E-plane dimension) for rectangular microstrip antennas. An upper bound is provided by the frequency for which the E-plane dimension is a half-wavelength. Author

N80-32610*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A QUANTITATIVE ANALYSIS OF INTER-ISLAND TELEPHONY TRAFFIC IN THE PACIFIC BASIN REGION (PBR)
David D. Evans and Clifford H. Arth Washington Sep. 1980 20 p refs
(NASA-TM-81587; E-566) Avail: NTIS HC A02/MF A01 CSCL 17B

As part of NASA's continuing assessment of future communication satellite requirements, a study was conducted to quantitatively scope current and future telecommunication traffic demand in the South Pacific Archipelagos. This demand was then converted to equivalent satellite transponder capacities. Only inter-island telephony traffic for the Pacific Basin Region was included. The results show that if all this traffic were carried by a satellite system, one-third of a satellite transponder would be needed to satisfy the base-year (1976-1977) requirement and about two-thirds of a satellite transponder would be needed to satisfy the forecasted 1985 requirement. Author

N80-32611# Indian Space Research Organization, Bangalore.
SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT. TELEVISION COMES TO VILLAGE: AN EVALUATION OF SITE
Binod C. Agrawal Oct. 1978 107 p refs
(ISRO-SAC-TR-09-78) Avail: NTIS HC A06/MF A01

The process of existing rural communication was studied. The role of TV as a new medium of communication in SITE instructional areas and the process of change brought about by TV in the rural structure at microlevel are discussed. Methods and techniques followed for this study are described. Cultural profiles of the villages under the study are presented in a comparative perspective. The reception of TV in the villages and the characteristics of the viewers and their program preference are described. The impact of TV on school children and teachers is also analyzed. R.K.G.

N80-32612*# Texas Univ. at Austin. Electrical Engineering Research Lab.
CTS ATTENUATION AND CROSS POLARIZATION MEASUREMENTS AT 11.7 GHz Final Report, 16 Jun. 1976 - 30 Jun. 1979
W. J. Vogel Jun. 1980 32 p refs
(Contract NAS5-22576)
(NASA-CR-160025) Avail: NTIS HC A03/MF A01 CSCL 20N

The long-term attenuation, cross-polarization, and rain-rate data monitored in Austin, Texas from the circularly polarized 11.7 GHz satellite beacon transmitter aboard the Communications Technology Satellite are analyzed. Data events are significantly more likely during April-September, than during October-March, except for ice depolorization which predominates during the winter months. A time of day dependence of the events is also noted. The 10 dB fade level is exceeded for .03% during the thunderstorm months. Isolation with the same probability is 23 dB. M.G.

N80-32613# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). National Council for Scientific and Technical Research.
DIFFRACTION OF A CASSEGRAIN ANTENNA SUBREFLECTOR [DIFRACAO DO SUB-REFLETOR DE UMA ANTENA TIPO CASSEGRAIN]
Carlos Alberto I. Miranda, Lucio Baptista T. Cividanes, and Carlos Eduardo Santana Jul. 1980 28 p refs In PORTUGUESE; ENGLISH summary
(INPE-1827-RPE/193) Avail: NTIS HC A03/MF A01

A solution for the field scattered by an axially symmetric subreflector, in the far field and near field regions, derived utilizing the induced current method. The formulation was applied to two subreflectors to investigate the effects of different peripheral illumination levels in the radiation pattern. For one of the subreflectors, the results of the near field and far field were compared. The conclusions presented are important in the design of Cassegrain antennas with gain optimization. T.M.

N80-32614# Harry Diamond Labs., Adelphi, Md.
APPROXIMATE CALCULATIONS OF RADIATION-INDUCED CURRENTS
Raine M. Gilbert May 1980 15 p refs Sponsored by the Defense Nuclear Agency
(AD-A087893; HDL-TM-80-2) Avail: NTIS HC A02/MF A01 CSCL 20/8

A simple procedure for calculating approximate values of radiation-induced currents is discussed. The procedure is intended for those who require only first-order estimates of such currents or who have neither time nor access to computer facilities for a more precise treatment. An example is given to illustrate the method. GRA

N80-32615# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
THE RECONSTRUCTION OF ANALOG SIGNALS FROM THE SIGN OF THEIR NOISY SAMPLES
Elias Masry 1 Aug. 1980 38 p refs
(Contract N00014-75-C-0652)
(AD-A087650) Avail: NTIS HC A03/MF A01 CSCL 09/3

The reconstruction of continuous-time signals s(t) from the sign of their (deliberately) contaminated samples is considered. Sequential, generally nonlinear estimates of s(t) are established and their performance is studied; error bounds and convergence rates are derived. The signal s(t) need not be bandlimited. The convergence rates obtained here are faster than those obtained for nonsequential estimates. The degradation in the reconstruction of the signal, due to transmission over an arbitrary noisy channel, is also investigated and bounds on the additional error are obtained. GRA

N80-32616# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
LOW SIDELOBE S-BAND LINE SOURCE ARRAY Interim Report
Gary E. Evans and William F. Hoover, Jr. Griffiss AFB, N.Y. RADC Mar. 1980 138 p
(Contract F19628-78-C-0151; AF Proj. 4600)
(AD-A087651; RADC-TR-79-338) Avail: NTIS HC A07/MF A01 CSCL 17/9

This report deals with the study and fabrication of a low

sidelobe, S-band linear dipole array. The specific design of this line source makes it directly applicable to a full size planar array for use in a high power, high efficiency, low sidelobe, tactical radar. Electrical and mechanical design details are discussed, including development of wideband, high isolation couplers, development of a crossed dipole radiator, the use of air dielectric stripline as a transmission medium, considerations regarding the corporate fed power divider, grating lobe considerations, size and weight budgets, and tactical constraints. Sources of both correlated and uncorrelated errors have been identified. A computer program is discussed which uses this error information to calculate statistically the azimuth patterns for the line source and for an array of N line sources. An error and tolerance budget has been determined that assures the array sidelobes to be below the -35, -38, -41, and -50dB level (first, second, third, and wide angle lobes, respectively. GRA

N80-32617# Army Missile Research and Development Command, Redstone Arsenal, Ala. Research Directorate.
PROCEEDINGS OF THE WORKSHOP ON MILLIMETER AND SUBMILLIMETER ATMOSPHERIC PROPAGATION APPLICABLE TO RADAR AND MISSILE SYSTEMS
Oskar M. Essenwanger, ed. and Dorothy A. Stewart, ed. Feb. 1980 187 p refs Workshop held 20-22 Mar. 1979, Redstone Arsenal, Ala.
(AD-A087754; AD-E950010; DRSMI-RR-80-3-TR) Avail: NTIS HC A08/MF A01 CSCL 20/14

A workshop on millimeter and submillimeter wave propagation through the atmosphere was held on 20-22 March 1979 at Redstone Arsenal, Alabama. This workshop served as a forum where scientists in diversified fields exchanged information on the latest results and discussed controversial issues and unresolved problems. The first few papers were concerned with MICOM needs. They specified the operating regions of interest for tactical applications and explained the rationale for the selection of these regions. The Terminal Homing Measurements program was described. Several papers discussed absorption by water vapor. Classical theories do not adequately describe the measured absorption in window regions between strong absorption lines. Alternate methods of explaining the discrepancies are to introduce reasonable modifications to existing models of line shapes or to consider the effect of water vapor dimers. Other effects on atmospheric propagation and instrumentation for measuring these effects were also discussed. Absorption and scattering by hydrometeors, dust and smoke were considered. Additional papers were concerned with terrain effects, turbulence, natural atmospheric emissions, refractivity gradients, and the relatively new method of pulse generation by swept-gain superradiance. GRA

N80-32618# Rome Air Development Center, Griffiss AFB, N.Y.
MULTIPATH PROPAGATION OVER SNOW AT MILLIMETER WAVELENGTHS
Uve H. W. Lammers and Dallas T. Hayes Feb. 1980 45 p refs
(AF Proj. 4600)
(AD-A087747; RADC-TR-80-54) Avail: NTIS HC A03/MF A01 CSCL 20/14

A series of multipath measurements over snow were conducted at Hanscom AFB during the winter 1978/1979. Data were obtained over a path-length of 179.5 m at frequencies of 35, 98, and 140 GHz. The gently rolling grass-covered terrain showed maximum height differences of 0.8 m. Snow covers included freshly fallen snow, old metamorphic snow, and sleet. The equipment consisted of CW transmitters at 2 m height and receivers mounted on a vertical positioner to measure the height-gain pattern of the received signal between 0.2 and 4 m height. Grazing angles for this geometry range between 0.5 and 2 degrees. Measured interference patterns between direct and terrain-reflected rays were generally coherent in appearance and exhibited cancellation depths of 20 dB and lower, depending on the type of snow cover. A computer program was developed in order to model the reflection as a specular process, with the underlying terrain represented by a series of linear sloping segments, derived from actual terrain height measurements. With appropriate transitions between the linear segments and reflection coefficients calculated from relevant snow parameters, calculated and measured height-gain patterns display quite similar qualities. GRA

N80-32619# Rome Air Development Center, Griffiss AFB, N.Y.
STATISTICAL CHARACTERIZATION OF ROUGH TERRAIN
John F. Lennon and Robert J. Papa Feb. 1980 43 p refs
(AF Proj. 2305)
(AD-A087746; RADC-TR-80-9) Avail: NTIS HC A03/MF A01 CSCL 20/14

A technique is presented to statistically characterize rough terrain surfaces. The approach is described in terms of a specific example but in principle is quite general and can be adapted to fit any number of situations. The starting point is the use of observed surface height data to generate statistical parameters for probability density functions (PDF) that potentially characterize the data. This involves the use of parameter estimation techniques. The estimated parameters are then used in an hypothesis test to determine the best PDF for the given data. The accuracy of the analysis depends on the available data, the estimators employed, and the determination of appropriate PDF's. The example consists of a large number of terrain regions in an area of eastern Massachusetts. Experimental data in the form of electromagnetic scattering from the surface are available for this site. Because of the number of cases involved, the complexity of the multivariate height distributions, and the type of measurements available, only a single observation of the multivariate data is used in the present analysis. Techniques to improve the parameter estimation are being pursued. The results of the statistical analysis in terms of mean height, variance, correlation, PDF, and a geologic feature characterizing each subregion are presented. These will be used in an electromagnetic scattering formulation to allow comparison with the experimental data. Once agreement is reached, other areas of interest can then be analyzed in a similar fashion. GRA

N80-32620# Semcor, Inc., Moorestown, N. J.
MILLIMETER WAVE RADAR SYSTEM CONCEPT STUDY, PHASE 1 Final Report, 1977 - 1978
Greg. Mansfield, Dan Lillie, and C. Shor Dover, N.J. ARRADCOM Aug. 1980 71 p
(Contract DAAK10-77-M-5014)
(AD-A087767; AD-E400454; ARSCD-CR-80012) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report represents the first phase of a three-phase concept study that is intended to produce a 'paper' design of a radar system capable of tracking low-flying subsonic aircraft at millimeter wave frequencies. GRA

N80-32621# Decision-Science Applications, Inc., Arlington, Va.
DEVELOPMENT AND EVALUATION OF AN EMISSIONS CONTROL DECISION AID Interim Report, Jul. 1978 - Jul. 1979
David F. Noble, George F. Pugh, James E. Densmore, Jr., and Max T. Nunenkamp Jul. 1980 156 p refs
(Contract N00014-77-C-0322)
(AD-A087358; DSA-246) Avail: NTIS HC A08/MF A01 CSCL 17/9

The DSA emissions control decision aid assists with the design and evaluation of mission control plans. As part of the Office of Naval Research operational decision aiding program, the aid was formally evaluated in tests conducted by an independent ONR consultant. This report describes modifications to the aid, preparation of user's manuals for test subjects, and development of scenarios for the test program. Aid improvements occurred primarily in response to suggestions during briefings, and suggest general principles of display design. The process for scenario development described here insured a set of test scenarios appropriate for an evaluation program. The user's manuals, included in the appendices describe how to use the aid to prepare EMCON plans. GRA

N80-32622# Republic Electronic Industries Corp., Melville, N.Y.
MULTIPLE THREAT GENERATOR (MTG-100) Final Technical Report, 1 Sep. 1978 - 11 Dec. 1979
J. Michaels May 1980 89 p refs
(Contract F30602-78-C-0229; AF Proj. 4506)
(AD-A087477; RADC-TR-80-151) Avail: NTIS HC A05/MF A01 CSCL 17/9

This technical report describes the Multiple Threat Generator (MTG-100) designed, developed, fabricated, installed and tested at Rome Air Development Center, by Republic Electronic

Industries Corp. The report describes the purpose of the equipment, and gives a functional description with a technical overview of both the hardware and software. Included in the report is an operational and maintenance procedure for the Multiple Threat Generator. GRA

N80-32623# ITT Defense Communications Div., Nutley, N.J.
SOLID STATE AUDIO/SPEECH PROCESSOR ANALYSIS Final Technical Report, 28 Sep. 1978 - 7 Dec. 1979
A. Richard Smith, B. Patrick Landell, and George Vensko Mar. 1980 99 p refs
(Contract F30602-78-C-0359; AF Proj. 4594)
(AD-A084743; RADC-TR-80-75) Avail: NTIS HC A05/MF A01 CSCL 09/2

The progress made in evaluating the feasibility of applying charge coupled devices (CCD's) as well as microprocessors to reduce the cost and complexity of automatic speech recognition (ASR) systems are discussed. Experiments were conducted to measure the speed versus accuracy tradeoffs of four speed up techniques. The techniques were demonstrated to be worthwhile in an efficient realtime automatic word recognition (AWR) system. Microprocessor architectures were designed to implement the realtime AWR system and then evaluated in terms of cost and complexity using three different microprocessors: the 8 bit Intel 8085A; the 16 bit Motorola MC68000; and a 16 bit configuration of the AMD 2901A. Of the three, the AMD 2901A proved preferable from both a cost and a performance standpoint. Hardware cost projections for an AWR system featuring an AMD 2901A architecture and a bandpass filter CCD analyzer indicate that the hardware components for such a system should range between $1,500 for a 52 word vocabulary, to about $12,700 for a 780 word vocabulary. R.C.T.

N80-32624# Army Materiel Development and Readiness Command, Alexandria, Va. Countermeasures/Counter-Countermeasures Office.
A COMPUTER PROGRAM TO ANALYZE SPREAD-SPECTRUM SYSTEM PERFORMANCE
Hal R. Harrelson Dec. 1979 75 p refs
(DA Proj. 1S4-63749-D-462)
(AD-A084179; CM/CCM-79-5) Avail: NTIS HC A04/MF A01 CSCL 17/4

A computer program was developed which analyzes and compares the performance of certain types of frequency hopping and psuedonoise (sometimes called direct sequence) spreadspectrum communication systems in the presence of hostile jamming. The program computes the probability of bit or word error as a function of the communication signal parameters (spectrum spreading methods, error-correcting coding, data modulation, bandwidth, etc) and the jamming parameters (jamming modulation, power, bandwidth). The output consists mainly of plots of error probability as a function of one or more of these parameters selected by the user. The plots are produced on an interactive computer graphics terminals, providing rapidly produced results and high user-computer interaction. GRA

N80-32625# SRI International Corp., Menlo Park, Calif.
DICE THROW UHF/SHF TRANSMISSION EXPERIMENT. VOLUME 3: FINAL DATA REDUCTION AND INTERPRETATION Progress Report, 16 Nov. 1976 - 19 Mar. 1979
Alan A. Burns and Patricia L. Crawley 1 Aug. 1979 142 p refs
(Contract DNA001-75-C-0206; SRI Proj. 3972)
(AD-A085760; DNA-4216T-3) Avail: NTIS HC A07/MF A01 CSCL 20/14

The final results from a radio frequency (rf) propagation experiment are presented. The experiment was designed to measure the effects of high-density, explosively produced dust clouds on a series of coherent signals ranging in frequency from 400 MHz to 10 GHz. Both amplitude and phase data were obtained. The observed rf results were found to be consistent with the behavior expected from theoretical considerations and dust densities obtained from a simple model based on material missing from the water and measured cloud volume. Because of the relatively small volume of space affected, rf effects were generally mild, unless a threshold combination of the dust density and the particle size distribution parameter were exceeded. Once the threshold was crossed, extinction coefficients rose to as much as several tens of decibels per kilometer. This was accompanied by the complete loss of a coherent signal component, strong fading, and the apparent onset of multiple scattering. T.M.

N80-32626# IIT Research Inst., Annapolis, Md.
TERRAIN SCATTER PARAMETER MODEL Phase Report, Oct. 1978 - Aug. 1979
J. T. Cochrane, Jr. Griffiss AFB, N.Y. RADC Feb. 1980 23 p ref
(Contract F19628-78-C-0006)
(AD-A084248; RADC-TR-80-11) Avail: NTIS HC A02/MF A01 CSCL 09/2

The development of computer programs to analyze multipath signals associated with the terrain over which a target aircraft is flying is addressed. The statistical characterization of terrain used as input to the calculation of the diffuse and specular reflections appropriate to the surface features in the vicinity of the radar is discussed. Author

N80-32627# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ELECTROMAGNETIC FIELDS INDUCED BY OCEAN CURRENTS Final Report, Jan. 1977 - Dec. 1978
Wasyl Wasylkiwsky Jul. 1979 297 p refs
(Contract MDA903-79-C-0202)
(AD-A085727; IDA-P-1399; IDA/HQ-79-21012) Avail: NTIS HC A13/MF A01 CSCL 17/6

A comprehensive account of analytical results for computing electromagnetic fields that are induced by ocean sea water as a result of its motion relative to the geomagnetic field is provided. Emphasis is on the characterization of magnetic field and magnetic field gradient environment. The theoretical results are formulated so as to be directly applicable to the computation of sea water generated magnetic noise and to the assessment of its deletrious effects on the sensitivity of magnetic sensors employed for magnetic anomaly detection over an open ocean. Magnetic field component and gradient spectra are computed both for stationary and moving observation platforms. Author

N80-32628# Naval Postgraduate School, Monterey, Calif.
TWO DIMENSIONAL MATCHED FILTERING FOR ATTITUDE MEASUREMENT WITH APPLICATIONS TO TARGET TRACKING M.S. Thesis
Robert Howard Williams Mar. 1980 104 p refs
(AD-A084413) Avail: NTIS HC A06/MF A01 CSCL 17/9

An application of two dimensional Fourier Transform correlation for the attitude measurement of three dimensional objects is considered. Geometric optical equations and geometric translation and rotation equations necessary for the image error calculations are included. Minimum attitude resolution equations are developed to estimate image quantization necessary for given measurement error. These techniques are then applied as an additional measurement to the radar tracking problem. Author

N80-32629# Utah Univ., Salt Lake City. Dept. of Computer Science.
NOISE SUPPRESSION METHODS FOR ROBUST SPEECH PROCESSING Semiannual Technical Report, 1 Oct. 1979 - 31 Mar. 1980
Steven F. Boll, H. Ravindra, G. Randall, R. Armantrout, and R. Power May 1980 38 p refs
(Contract N00173-79-C-0045; ARPA Order 3301)
(AD-A085667; UTEC-CSC-80-058) Avail: NTIS HC A03/MF A01 CSCL 17/2

Robust speech processing in practical operating environments requires effective environmental and processor noise suppression. This report describes the technical findings and accomplishments during this reporting period for the research program funded to develop real time, compressed speech analysis synthesis algorithms whose performance in invariant under signal contamination. Fulfillment of this requirement is necessary to insure reliable secure compressed speech transmission within realistic military command and control environments. Overall contributions resulting from this research program include the understanding of how environmental noise degrades narrow band, coded speech, development of appropriate real time noise suppression algorithms, and development of speech parameter identification methods that consider signal contamination as a fundamental element in the

estimation process. This report describes the current research and results in the areas of noise suppression using the dual input adaptive noise cancellation using the short time Fourier transform algorithms, articulation rate change techniques, and a description of an experiment which demonstrated that the spectral subtraction noise suppression algorithm can improve the intelligibility of 2400 bps, LPC 10 coded, helicopter speech by 10.6 point. GRA

N80-32630# Hughes Aircraft Co., El Segundo, Calif. Radar Systems Group.
TARGET IDENTIFICATION USING RADAR IMAGERY AND MOMENT METHODS Final Report, Sep. 1979 - Jun. 1980
George A. Ioannidis and Charles B. Dolan Jun. 1980 156 p refs
(Contract N00014-79-C-0643)
(AD-A088514; HAC-FR-80-23-919R; HAC-REF-E5599) Avail: NTIS HC A08/MF A01 CSCL 17/9

In the past, most radar target recognition techniques have concentrated on the use of one dimensionsal target signatures. However, the development of the Synthetic Aperture Radar (SAR) and the recent development of the Inverse Synthetic Aperture (ISAR) technologies have made it possible to obtain radar images of targets and thus allow the use of two dimensional pattern classification schemes for automatic radar target recognition. One such two dimensional shape recognition scheme is a technique known as the method of moments, which has been successfully applied to the recognition of objects imaged in the visible and infrared spectrum. The images used in this investigation were generated by the application of the ISAR technique to turntable radar data and also data obtained from flying aircraft targets. GRA

N80-32631# Calspan Advanced Technology Center, Buffalo, N.Y.
DERIVATION OF NARROWBAND FREQUENCY-AGILE RADAR SIGNATURES FROM WIDEBAND DATA ANALYSIS OF X-BAND DATA Final Report, 7 Sep. 1978 - 7 Mar. 1979
B. H. Mohlke, R. A. Padgug, C. M. Szczesny, and P. M. McMahon Nov. 1979 49 p
(Contract F33615-78-C-1617; AF Proj. 2136)
(AD-A088376; AFAL-TR-79-118723; CALSPAN-6384-S-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

This investigation demonstrated theoretically and experimentally that frequency-agile narrowband radar signatures can be derived from wideband data. The experimental work used X-band satellite data from Lincoln Laboratory's Long Range Imaging Radar (Haystack). The computer programs required for deriving narrowband signatures from two dimensionnal radar images were delivered to AFAL with this report. GRA

N80-32632# Weapons Systems Research Lab., Adelaide (Australia).
AN ITERATIVE APPROACH TO THE DECONVOLUTION OF THE NARROWBAND OUTPUTS OF A CONVENTIONAL BEAMFORMER
D. A. Gray Feb. 1980 31 p refs
(AD-A088276; WSRL-0141-TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

In conventional beamforming the estimated noise power wave number spectrum is the convolution of the incident distribution with the array response. By removing the effect of the array response an improved estimate of the incident wave-number spectrum may be obtained. In particular the method of progressive substitutions has been widely used to deconvolve array window. By assuming all the incident signals to be a linear super-position of a finite number of plane waves this method is extended to deconvolve the narrowband beam outputs of a conventional beamformer. Two methods are used, the first to deconvolve the complex beam amplitudes and the second to deconvolve the beam powers. The convergence of these proposed interactive solutions is proved and the relationship of the limits to some recently proposed quadratic estimators is shown. GRA

N80-32633# Naval Research Lab., Washington, D. C.
COMPUTATIONS OF THE RADIATION PATTERN OF A REFLECTOR ANTENNA Interim Report
J. K. Hsiao 26 Aug. 1980 19 p refs
(WF34372000)
(AD-A088273; NRL-MR-4325) Avail: NTIS HC A02/MF A01 CSCL 20/14

This report describes a mathematical approach to compute the radiation pattern of a reflector antenna. The radiation integral is expanded into an orthogonal series in terms of a field point coordinate. Since this series is orthogonal, coefficients of this series can be easily determined. Once these coefficients are known, radiation patterns at any field point can be readily computed. Since this approach avoids performing the integration of the radiation integral at each field point, it greatly reduces the required computation. A brief description of the computer program is also included in this report. GRA

N80-32634# Naval Research Lab., Washington, D. C. Radar Div.
PRESENT AND FUTURE TRENDS IN SIGNAL PROCESSING TECHNOLOGIES Interim Report
Peter N. Marinos 11 Aug. 1980 32 p refs
(AD-A088085; NRL-MR-4299) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report provides a quick overview of various signal processing technologies and evaluates their impact on modern radar design in the 1980's. Although primary emphasis is placed on conventional solid-state technologies, a serious effort has been made to review more exotic physical phenomena and related technologies which have attracted, recently, a great deal of interest and are no longer viewed as scientific curiosities. The latter group includes surface acoustic waves (SAW), charge-coupled devices (CCD), magnetic bubble memories (MBM), Josephson junction (JJ) devices, and acousto-optics. GRA

N80-32635# Air Force Medical Center, Wright-Patterson AFB, Ohio.
VOICE COMMUNICATION RESEARCH EVALUATION SYSTEM
Richard L. McKinley May 1980 17 p refs
(AF Proj. 7231)
(AD-A088100; AFAMRL-TR-80-25) Avail: NTIS HC A02/MF A01 CSCL 17/2

Aircraft voice communications may be degraded by a variety of sources such as electrical and/or acoustical noise, radio interference, jamming and various other forms of distraction. The Voice Communication Research and Evaluation System, located in the Biodynamics and Bioengineering Division of the Aerospace Medical Research Laboratory, has been developed for the comprehensive analysis and enhancement of operational voice communication. The basic system is comprised of a multi-station voice communication network consisting of the USAF standard aircraft intercommunication system, a standard A-19 diluter-demand oxygen regulation system and an on line computer data collection and data analysis system that displays results in real time. The system is housed in a large reverberation chamber containing a programmable sound source capable of reproducing the spectrum and level of any AF operational noise environment. Standardized voice communication effectiveness test materials are used to assess the performance of any aspect of the total voice communication link, however, emphasis is usually placed upon the performance of the aircrew members. This paper will descibe the salient features of this unique system and provide examples of its application to voice communication problems. GRA

N80-32636# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
ELASTIC WAVE PROPAGATION THROUGH MULTILAYERED MEDIA Final Report, 1 May - 1 Oct. 1979
Dale E. Chimenti and Robert L. Crane Mar. 1980 69 p refs
(AF Proj. 2418)
(AD-A088030; AFML-TR-79-4214) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report presents a review of the theory of elastic wave propagation in any number of fluid or solid layered media. Suitable wave equations are derived, and boundary conditions determined by the nature of the media and the character of the interfaces are applied, yielding a formal solution for the transmitted and reflected, longitudinal and transverse wave potentials. Computer-

generated graphs are presented which illustrate properties of the solutions in materials of interest in nondestructive evaluation. A tabulation of acoustic-velocity data for media commonly encountered in ultrasonic work is also included. GRA

N80-32637# Naval Research Lab., Washington, D. C.
A STUDY OF POWER AND ENERGY IN THE AURORA MODIFICATION PROJECT Final Report
John D. Shipman, Jr. 23 Jul. 1980 28 p
(AD-A088051; NRL-MR-4281) Avail: NTIS HC A03/MF A01 CSCL 20/3

This report summarizes the results of a series of computer runs at NRL which were designed to determine if the measured loss of power and energy in the Aurora Modification Project tests in the Fall of 1978 was due to increasing capacitance in the water switches during the transit times of the streamers or was due to resistive losses in the water switches. From the results of these analyses, it is concluded that the losses were mainly due to resistance in the intermediate store and pulse forming liner output switches and that the changing switch capacitance mainly rounded the pulse shapes near the peak values without contributing to a major loss of energy. It is suggested that oil switches be considered as a replacement for the water switches since they have less loss, although there are risks and problems involved in their use. GRA

N80-32638# Naval Research Lab., Washington, D. C. Communications Sciences Div.
EXPERIMENTAL MEASUREMENTS OF AMBIENT ELECTROMAGNETIC NOISE FROM 1.0 TO 4.0 kHz Final Report
Robert J. Dirger, William D. Meyers, and John R. Davis 31 Jul. 1980 64 p refs
(RR0210141)
(AD-A088090; NRL-8413) Avail: NTIS HC A04/MF A01 CSCL 04/1

The spectral noise density, amplitude probability distribution (APD), and spectral content of ambient noise from 1.0 to 4.0 kHz were measured. Analysis of the recorded data included detailed investigation of the diurnal variation of the noise, comparison of the APDs with two atmospheric noise models, time domain excision of noise impulses to assess the reduction in noise achievable by nonlinear processing, investigation of broadband ionospheric emissions identified as polar chorus, and determination of the statistical variation (in frequency) of the spectral minimum near 3 kHz. The analysis of the diurnal variation suggested the existence of a large propagation anisotropy in the nighttime Earth ionosphere waveguide at 3 kHz, with east to west attenuation significantly lower than north-south attentuation. The observed seasonal and geographical averaged diurnal variations can be interpreted qualitatively in terms of worldwide thunderstorm distributions and day-night changes in the reflecting height of the ionospheric D-layer. The measured spectral noise density values are significantly lower than values measured under similar conditions by earlier investigations; the lower values are attributed to the use of a receiver with a lower intrinsic noise and careful site selection to avoid man made interference. The recorded APDs varied from a Rayleigh form during low noise periods in Norway to a distribtution with a tail at low exceedence values during higher noise periods in both Norway and Italy. Comparison of the APDs with the Field-Lewenstein model and the Middleton model generally showed satisfactory agreement. GRA

N80-32639# Rome Air Development Center, Griffiss AFB, N.Y.
A PARABOLIC CYCLINDER REFLECTOR SYSTEM WITH LOW SIDELOBES: EXPERIMENTAL RESULTS Final Report
Peter R. Franchi, Nicholas P. Kerweis, and Lance F. Dennett Nov. 1979 22 p ref
(AF Proj. 4600)
(AD-A088202; RADC-TR-79-312) Avail: NTIS HC A02/MF A01 CSCL 17/9

An off-set parabolic cylinder reflector system with low sidelobes is described, and experimental results are presented to substantiate the theoretical design. A reduced height waveguide primary feed system superimposing the TE(10) and TE(30) waveguide modes was designed, fabricated, and tested so that the required bandwidth and far field radiation patterns could be realized. GRA

N80-32640# Naval Ocean Systems Center, San Diego, Calif.
SATELLITE SENSING OF THE SOLAR-TERRESTRIAL ENVIRONMENT AND REAL-TIME RADIO PROPAGATION FORECASTING. LESSONS LEARNED FROM PROPHET. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1972 - 1979
R. B. Rose (NOSC, San Diego, Calif.) and P. H. Levine 30 Sep. 1979 50 p refs
(Contract N00123-78-C-0043)
(AD-A088170; NOSC/TR-487-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

PROPHET denotes a class of radio propagation forecast terminals which represent the culmination of an 11 year development effort at the Naval Ocean Systems Center (NOSC) under the SOLRAD satellite program. The system is unique in that it provides a real-time link between Navy operations personnel and a worldwide network of ground-based and satellite-borne solar-terrestrial environment monitors. This link is used to generate - via distributed data processing - electromagnetic system performance predictions in formats specially tailored to meet the operational requirements of the user. An initial implementation of PROPHET has provided - over a 3 year period - highly successful hf frequency/antenna management support to the Technical Control Facility of the Naval Communication Station at Stockton, CA. This executive summary provides a concise overview of the evolution, structure, function, and accomplishments of PROPHET, together with recommendations for ways in which the PROPHET technology can be applied to recognized operational requirements fo the Navy. Technical details are elaborated in volume 2. GRA

N80-32641# M&S Computing, Inc., Huntsville, Ala.
INFORMATION ANALYSIS OF DYNAMICAL RADAR PARAMETERS
H. Vincent Poor 1 Apr. 1980 23 p refs
(Contract DAAK40-79-D-0018)
(AD-A088195; Rept-80-036; DRSMI-RE-CR-80-12) Avail: NTIS HC A02/MF A01 CSCL 17/9

This report examines the extension of the classical information analysis of radar systems to more general situations arising in modern radar practice. In particular, the introduction of dynamics into parameter modeling is considered in an information theoretical context. Such a treatment is motivated by the need to consider parameter dynamics in discrimination-mode radar signal processor design. Expected applications of the proposed techniques include development of theoretical performance limitations which can be used as benchmarks to which the performance of practical systems can be compared. GRA

N80-32642# Illinois Univ. at Urbana-Champaign, Urbana. Electromagnetics Lab.
RADIATION FROM AN OPEN-ENDED WAVEGUIDE WITH BEAM EQUALIZER. A SPECTRAL DOMAIN ANALYSIS
W. L. Ko, R. Mittra, and S. W. Lee Jul. 1980 38 p refs
(Contract N00014-75-C-0293)
(AD-A088179; UIEM-80-6; UILU-ENG-80-2547) Avail: NTIS HC A03/MF A01 CSCL 20/14

A septum and an impedance matching post are used as a beam equalizer in an open-ended waveguide-feed for reflectors used in satellite communications systems. The performance of this design over a frequency band is evaluated using a spectral domain approach. The computed radiation patterns in the E- and H-planes, as well as the results for the impedance match, are presented. GRA

N80-32643# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN ANALYSIS OF FOLIAGE EFFECTS ON LONG-RANGE SURVEILLANCE
Donna L. Hogan 23 Apr. 1980 55 p refs
(Contract F19628-80-C-0002; AF Proj. 2217)
(AD-A088163; TN-1980-9; ESD-TR-80-29) Avail: NTIS HC A04/MF A01 CSCL 17/9

Visibility is one of the key factors in determining the outcome of battles. With the advent of long range, moving target, air to ground surveillance radars, the motion of both the observing platform and the target have added to the visibility problem, which heretofore was analyzed in terms of shielding. The interaction of such factors as the minimum detectable velocity

of the target, the trajectories of the target and the airborne radar platform, and the terrain and foliage masking combine to control the amount of time which a target is observed in a given scenario. This report continues the work done on dynamic masking, compares the masking calculation with and without foliage on a typical super highway in New England, and finally examines the correlation between predicted and observed foliage and terrain masking. The work was done in connection with the test and evaluation of the Multiple Antenna Surveillance Radar (MASR), a scaled model of a long range moving target surveillance system. MASR operated at L-band with a beamwidth of approximately 4.5 deg. In typical flight operation it observed the target complex from a range of 25 to 40 km. The altitude was selected to give lookdown angles ranging from 3 deg to 6 deg. GRA

N80-32644# SRI International Corp., Menlo Park, Calif.
OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA. PART 1: BASIC EIS APPENDICES Final Environmental Impact Statement
Jul. 1980 496 p refs
(Contract F08635-76-D-0132)
(AD-A088320; AFSC-TR-80-09) Avail: NTIS
HC A21/MF A01 CSCL 17/9

The document is the Final Environmental Impact Statement on the operation of the Pave Paws Radar System at Beale Air Force Base California. GRA

N80-32645# SRI International Corp., Menlo Park, Calif.
OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA. PART 2. PUBLIC COMMENT AND AIR FORCE RESPONSE Final Environmental Impact Statement
Jul. 1980 192 p
(Contract F08635-76-D-0132)
(AD-A088321; AFSC-TR-80-10) Avail: NTIS
HC A09/MF A01 CSCL 17/9

This document presents the public comment and Air Force response to the Final Environmental Impact Statement on the Operation of the Pave Paws Radar System at Beale Air Force Base California. GRA

N80-32646# National Academy of Sciences - National Research Council, Washington, D. C. Engineering Panel on the PAVE PAWS Radar System.
RADIATION INTENSITY OF THE PAVE PAWS RADAR SYSTEM
1979 50 p refs
(Contract F49620-78-C-0118)
(AD-A088323; AFSC-TR-80-12) Avail: NTIS
HC A03/MF A01 CSCL 17/9

In May 1978, when the U.S. Air Force requested the National Research Council to assess certain aspects of its newest missile defense warning system then under construction at the Otis Air Force Base on Cape Cod, Massachusetts, the facility was the subject of intense public concern that exposure to its radiation emissions might be harmful to humans. The purpose of the radar facility, known as PAVE PAWS (PAVE being a code word for the Air Force unit in charge of the project PAWS, an acronym for Phased Array Warning System) is to detect and track ballistic missiles launched at sea as far as 3,000 nautical miles from U.S. shores. In order to discern ballistic missiles early in their trajectory, it operates at an angle as low as 3 degrees above the horizon. Its long range capacity is achieved by a fairly high average power level of 145kW. The Research Council's initial response was to establish two separate panels to examine the facility--one, the Engineering Panel on the PAVE PAWS Radar System, under the Assembly of Engineering, and the other the Panel on the Extent of Radiation from the PAVE PAWS Radar System Assembly of Life Sciences. This is the report of the Engineering Panel. The report of the second panel, consisting of an analysis of the exposure levels and potential biological effects of PAVE PAWS, will be published separately. GRA

N80-32647# Sandia Labs., Albuquerque, N. Mex. Applied Biology and Isotope Utilization Div.
ANALYSIS OF A FINITE LENGTH TUBULAR MONOPOLE ANTENNA DRIVEN BY A COAXIAL LINE
Marvin E. Morris May 1980 44 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1557) Avail: NTIS HC A03/MF A01

The problem of a coaxially-driven, finite length tubular monopole antenna over an infinite ground plane is formulated as a rigorous boundary value problem. The resulting coupled pair of singular integral equations is numerically solved for the electric field in the end of the coaxial line and for total current on the antenna. The electric field is used to compute the admittance of the antenna. The admittance, electric field, and current are presented for a wide range of experimentally useful parameters. DOE

N80-32648# Sandia Labs., Albuquerque, N. Mex.
ADMITTANCE OF AN INFINITELY LONG MONOPOLE ANTENNA IMMERSED IN A DISSIPATIVE MEDIUM AND DRIVEN BY AN AIRFILLED COAXIAL LINE
Marvin E. Morris May 1980 23 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1401) Avail: NTIS HC A02/MF A01

The effect of the dielectric interface between the medium being probed and the end of the coaxial line used to drive the antenna on admittance is discussed. The infinite monopole antenna driven with a coaxial line is used as a model to determine this effect. The integral equation appropriate to this geometry is numerically solved for a wide range of parameters and it is determined that the interface affects the admittance only slightly compared to the more significant effect of changing the drive geometry. The capacitive admittance correction due to the dielectric interface can be ignored for most experimental purposes for antennas immersed in nondissipative media. In dissipative media the situation is more complex. DOE

N80-32649# California Univ., Livermore. Lawrence Livermore Lab.
MATRIX THEORY OF ELASTIC WAVE SCATTERING: APPLICATION TO SCATTERING OF TRANSVERSE WAVES
Jon L. Opsal 25 Mar. 1980 6 p refs Presented at ARPA/AF Review of Progress in Quantitative NDE, La Jolla, Calif., 8 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-84116; CONF-790757-4) Avail: NTIS
HC A02/MF A01

Calculations of elastic wave scattering using the method of optimal truncation are made for transverse waves incident on axially symmetric defects. Longitudinal incident waves are also considered with the results in agreement with those obtained previously. A number of features for incident transverse waves are presented as well as some of the practical aspects of the calculation (e.g., convergence, accuracy, and computer time). DOE

33 ELECTRONICS AND ELECTRICAL ENGINEERING

includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-32650* National Aeronautics and Space Administration. Pasadena Office, Calif.
APPARATUS FOR MEASURING SEMICONDUCTOR DEVICE RESISTANCE Patent
Walter J. Matzen, inventor (to NASA) (Texas Instruments, Inc., Dallas) Issued 19 Aug. 1980 8 p Filed 23 Jun. 1978 Supersedes N78-28340 (16 - 19, p 2520) Sponsored by NASA
(NASA-Case-NPO-14424-1; NASA-Case-NPO-14430-1; US-Patent-4,218,650; US-Patent-Appl-SN-918534; US-Patent-Class-324-62; US-Patent-Class-324-64) Avail: US Patent and Trademark Office CSCL 09A

A test structure is described for enabling the accurate

measurement of the resistance characteristics of a semiconductor material and includes one or more pairs of electrical terminals disposed on the surface of the material to enable measurements of the resistance encountered by currents passed between the terminals. A pair of terminals includes a first terminal extending in a closed path, such as a circle, around a second terminal, so that all currents flowing between the terminals flow along a region of known width and length. Two or more pairs of concentric terminals can be utilized, wherein the ratio of radii of each pair of terminals is the same as the ratio for all other pairs of terminals, to facilitate the calculation of the contact resistance between each terminal and the semiconductor surface, as well as the calculation of the resistance of the semiconductor material apart from the effect of the terminal to semiconductor contact resistances.

Official Gazette of the U.S.Patent and Trademark Office

N80-32651*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ELECTRICAL SELF-ALIGNING CONNECTOR Patent Application

Keith H. Clark and Donald R. Scott, inventors (to NASA) Filed 15 Jul. 1980 13 p

(NASA-Case-MFS-25211-1; US-Patent-Appl-SN-168995) Avail: NTIS HC A02/MF A01 CSCL 09A

A self aligning electrical connector device including a receptacle component having a conically contoured interior and a plug component having a correspondingly contoured conical body receivable in the receptacle component is disclosed. The plug component includes a plurality of spaced conductive ring elements having a mating face and the receptacle component includes a plurality of corresponding spaced conductive ring elements providing mating interface with the mating face of the ring elements of the plug component when connected therewith. Each ring element of the receptacle component includes a plurality of segmented portions which defect downwardly when the plug component is inserted therein to assert a biasing force against the face of the ring elements of the plug component providing positive electrical contact and connection between the ring elements of the components. NASA

N80-32652*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.

CONTROL ELECTRONICS FOR A MULTI-LASER/MULTI-DETECTOR SCANNING SYSTEM

William Kennedy Aug. 1980 113 p refs

(Grant NsG-7359; Contract JPL-954880)

(NASA-CR-163565; RPI-TR-MP-73) Avail: NTIS HC A06/MF A01 CSCL 09C

The Mars Rover Laser Scanning system uses a precision laser pointing mechanism, a photodetector array, and the concept of triangulation to perform three dimensional scene analysis. The system is used for real time terrain sensing and vision. The Multi-Laser/Multi-Detector laser scanning system is controlled by a digital device called the ML/MD controller. A next generation laser scanning system, based on the Level 2 controller, is microprocessor based. The new controller capabilities far exceed those of the ML/MD device. The first draft circuit details and general software structure are presented. S.F.

N80-32653*# RCA Solid State Div., Somerville, N.J. Solid State Div.

ACCELERATED LIFE TESTING EFFECTS ON CMOS MICROCIRCUIT CHARACTERISTICS Final Report, May 1976 - Dec. 1979

1980 89 p

(Contract NAS8-31905)

(NASA-CR-161575) Avail: NTIS HC A05/MF A01 CSCL 09C

This report covers the time period from May 1976 to December 1979 and encompasses the three phases of accelerated testing: Phase 1, the 250 C testing; Phase 2, the 200 C testing; and Phase 3, the 125 C testing. The duration of the test in Phase 1 and Phase 2 was sufficient to take the devices into the wear out region. The wear out distributions were used to estimate the activation energy between the 250 C and the 200 C test temperatures. The duration of the 125 C test, 20,000 hours, was not sufficient to bring the test devices into the wear out region; consequently the third data point at 125 C for determining the consistency of activation energy could not be obtained. It was estimated that, for the most complex of the three device types, the activation energy between 200 C and 125 C should be at least as high as that between 250 C and 200 C. The practicality of the use of high temperature for the accelerated life tests from the point of view of durability of equipment was assessed. Guidelines for the development of accelerated life test conditions were proposed. The use of the silicon nitride overcoat to improve the high temperature accelerated life test characteristics of CMOS microcircuits was explored in Phase 4 of this study and is attached as an appendix to this report. E.D.K.

N80-32654*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

S AND Ku BAND FREQUENCY SOURCE DEVELOPMENT Final Report

Aug. 1980 104 p refs

(Contracts NAS5-25095; NAS5-23822)

(NASA-CR-160033) Avail: NTIS HC A06/MF A01 CSCL 09C

The results of the two part S- and Ku-band source development program are described. The S- and Ku-band sources were designed, fabricated, and evaluated. A high performance S- and Ku-band microwave signal source using state-of-the-art oscillator and microwave source technology was developed. T.M.

N80-32655*# Old Dominion Univ., Norfolk, Va.

PRELIMINARY DEVELOPMENT OF DIGITAL SIGNAL PROCESSING IN MICROWAVE RADIOMETERS Final Report, 1 Jan. - 31 Dec. 1979

William D. Stanley Sep. 1980 145 p refs

(Contract NAS1-15676)

(NASA-CR-3327) Avail: NTIS HC A07/MF A01 CSCL 09C

Topics covered involve a number of closely related tasks including: the development of several control loop and dynamic noise model computer programs for simulating microwave radiometer measurements; computer modeling of an existing stepped frequency radiometer in an effort to determine its optimum operational characteristics; investigation of the classical second order analog control loop to determine its ability to reduce the estimation error in a microwave radiometer; investigation of several digital signal processing unit designs; initiation of efforts to develop required hardware and software for implementation of the digital signal processing unit; and investigation of the general characteristics and peculiarities of digital processing noiselike microwave radiometer signals. A.R.H.

N80-32656*# Watkins-Johnson Co., Palo Alto, Calif.

DESIGN, FABRICATE AND TEST AN ELECTRON BOMBARDED SEMICONDUCTOR (EBS) AMPLIFIER Final Report

S. F. Blazo and J. B. Rettig [1980] 42 p

(Contract NAS5-20881)

(NASA-CR-160002) Avail: NTIS HC A03/MF A01 CSCL 09A

The deflected beam EBS amplifier consisting of: an electron gun which forms a high energy, low current electron beam, a meander line deflection structure which deflects the electron beam in accordance with the RF input; and a target consisting of an array of EBS diodes, along with the impedance matching circuitry was developed. An efficient and linear 50 W CW EBS amplifier operating at 1.6 GHz suitable for space communication applications is discussed. At this level, the target efficiency was about 45 percent, showing that high efficiency operation could be obtained. Linear operation, so important for multisignal operation and efficient utilization of the limited frequency spectrum, was demonstrated with a gain variation of + or - 1 dB over a 30 dB dynamic range. Microstrip matching techniques were developed and are used in high frequency applications. R.K.G.

N80-32657# National Bureau of Standards, Washington, D.C. Electromagnetic Technology Div.

JOSEPHSON A/D CONVERTER DEVELOPMENT Annual Technical Report, 1 May 1978 - 30 Apr. 1979

C. A. Hamilton, R. E. Harris, R. L. Kautz, F. L. Lloyd, and R. L. Peterson 1 Sep. 1979 67 p refs

(Contract N00014-79-F-0005; NR Proj. 383-040)
(AD-A087671; SR-724-15-80) Avail: NTIS
HC A04/MF A01 CSCL 09/5

This report describes the second year of an effort to demonstrate an ultra-high-speed analog-to-digital converter using superconducting electronics. A converter was fabricated and tested, producing 200 to 700 megasamples per second. Experimental and theoretical support work is also presented. GRA

N80-32658# Aeronautical Research Labs., Melbourne (Australia).
A SIMPLIFIED DIGITAL FILTER DESIGN
A. J. Farrell Feb. 1980 37 p refs
(AD-A087772; ARL/AERO-TM-320) Avail: NTIS
HC A03/MF A01 CSCL 09/1

An eight-step procedure for the design of digital Butterworth low-pass filters is outlined which summarizes the methods of several standard textbooks on digital filter design. Examples of filters designed using the procedure are included. GRA

N80-32659# Harris SAI, Inc., Ann Arbor, Mich.
VARIATIONAL ANALYSIS OF HELICAL SLOW WAVE STRUCTURES Final Technical Report, 25 Oct. 1978 - 24 Jan. 1980
T. P. Fontana and D. M. MacGregor May 1980 91 p refs
(Contract F30602-79-C-0013; AF Proj. 4506)
(AD-A087478; RADC-TR-80-174) Avail: NTIS
HC A05/MF A01 CSCL 20/14

A variational technique has been used in predicting impedance and dispersion characteristics for the cold test measurements of helical traveling wave tubes. The variational formula of Bevensee is used in this method. An optimal combination of slow wave trial fields is found using Rumsey's reaction integral as a measure of equivalence to the true fields. In contrast to other approximate analyses, the variational formulation has the advantage of including the exact geometry and dielectric of the helical support. In order to verify the technique, two trial field regions have been used in successfully analyzing the sheath helix and the case of a homogeneous dielectric support. A composite metal-ceramic helix has also been analyzed. Simulation for the composite helix shows a reasonable dispersion for some combinations of harmonics over a wide frequency range when results are compared to experiment. However, the impedance computation is not yet satisfactory. In future developments, major modifications will be made to the trial fields in order to satisfy all boundary conditions simultaneously and improve the predicted impedance. In addition, the technique will be applied to other devices including wedge and rod supports. GRA

N80-32660# Air Force Weapons Lab., Kirtland AFB, N. Mex.
RADIATION EVALUATION STUDY OF LSI RAM TECHNOLOGIES Final Report
Gregory L. Dinger and Michael G. Knoll Jan. 1980 63 p refs
(AD-A084168; AD-E200471; AFWL-TR-79-118) Avail: NTIS
HC A04/MF A01 CSCL 09/3

Five commercial LSI static random access memory technologies having a 1 kilobit capacity were radiation characterized. Arrays from the transistor-transistor-logic (TTL), Schottky TTL, n-channel metal oxide semiconductor, complementary metal oxide semiconductor (CMOS), and CMOS/silicon on sapphire families were evaluated. Radiation failure thresholds for gamma doserate logic upset, total gamma dose survivability, and neutron fluence survivability were determined. A brief analysis of the radiation failure mechanism for each of the logic families tested is included. Author

N80-32661# Naval Postgraduate School, Monterey, Calif.
INTEGRATED CIRCUIT DESIGN OF A VIDEO RECONSTRUCTOR FOR A RANGE-GATED MOVING TARGET INDICATOR M.S. Thesis
George Achilleus Papadopoulos Dec. 1979 101 p refs
(AD-A084376) Avail: NTIS HC A06/MF A01 CSCL 09/5

The video reconstructors circuit of the channelized or range gated moving target indicator (MTI) is designed for integration or a single dual-in-line integrated circuit package. The developed chip model is tested and its performance evaluated for a wide range of operating conditions. The tests indicate that the model offers superior performance using discrete components. An extension of the technique offers opportunities in reducing the majority of the remaining channel elements to chip size. For many MTI applications this will yield still additional benefits. Full transistor-transistor-logic compatibility of the design makes the devices easily controllable with digital logic. The threshold voltage setting, the output gate control, and the integration time constant can be set by software or firmware. Author

N80-32662# Army Electronics Research and Development Command, Fort Monmouth, N. J.
ACCELERATION SENSITIVITY COMPENSATION OF CRYSTAL RESONATORS
Arthur Ballato Mar. 1980 78 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A085683; DELET-TR-80-7) Avail: NTIS
HC A05/MF A01 CSCL 14/2

Resonator configurations compensated for arbitary directions of the acceleration field, and requiring no additional electronics other than the oscillator circuitry normally used are described. This approach produces compensation with no changes in size, weight, and power, and applies to any crystal reference oscillator in any shock/vibration environment. Author

N80-32663# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
ELECTROLUMINESCENT DISPLAY TECHNOLOGY
M. Robert Miller and Elliot Schlam Apr. 1980 13 p
(DA Proj. 1L1-62705-AH-9403)
(AD-A085641; DELET-TR-80-9) Avail: NTIS
HC A02/MF A01 CSCL 09/5

The development of the current high contrast, sunlight legible, thin film electroluminescent display technology is reviewed and device structures and operating characteristics are described. Drive and addressing considerations are presented in relation to device types, power dissipation, multiplexing, and viewability. An overview of the industry status is given including device availability and problems remaining to be solved. Applications of the technology are reviewed covering both user requirements and device capabilities. A survey of future prospects covers improvements in efficiency, multicolor displays, and various device configurations. E.D.K.

N80-32664# Science Applications, Inc., La Jolla, Calif.
ANALYTIC APPROACHES TO UNSTABLE RESONATORS Final Report
J. Nagel and D. Rogovin Jun. 1980 18 p refs
(Contract F49620-79-C-0027; AF Proj. 2301)
(AD-A088378; AFOSR-80-0623TR) Avail: NTIS
HC A02/MF A01 CSCL 09/1

The marginally stable regime has been distinguished from the unstable regime both qualitatively and quantitatively. New asymptotic techniques for solving the Fresnel-Kirchoff equation for marginally stable resonators were obtained. The method is analytical in nature and yields excellent predictions for the modes and losses of such cavities. Numerical results for both marginally stable and marginally unstable cavities are presented. In addition, conditions for the suitability of using empty resonator modes to describe gain filled cavities have been derived. This deviation is based on manipulations of the differential equation describing gain filled cavities in Hankel transform space. The result is an ordinary, linear Fresnel-Kirchoff integral equation with gain renormalized Fresnel number and eigenvalue. GRA

N80-32665# Thomas Electronics Inc., Wayne N. J.
PHOSPHOR-PENETRATION COLOR CATHODE-RAY TUBE Final Report, 1 Jul. 1974 - 30 Jun. 1979
Emil Sanford Jun. 1979 49 p refs
(Contract DAAB07-74-C-0605; DA Proj. 1S7-62705-AH-94)
(AD-A088518; WO-373; DELET-TR-74-C-0605-F) Avail: NTIS
HC A03/MF A01 CSCL 09/1

In a 16 *in.* diameter voltage penetration type color CRT a metallic mesh is mounted in proximity to the phosphor layer in order to isolate the switched high voltage fields applied to the phosphor screen from the magnetic deflection zone. Electron optical analysis predicts the degree of geometric distortion over the switching range of 10-20 kV. Some correction means are suggested. Objective goals for resolution and brightness are

quantitatively examined. The mechanical design is also described. GRA

N80-32666# Purdue Univ., Lafayette, Ind.
PRANC: PROGRAM FOR ANALYZING NONLINEAR CIRCUITS Final Phase Report, Nov. 1978 - Nov. 1979
H. K. Thapar and B. J. Leon Griffiss AFB, N.Y. RADC May 1980 241 p refs
(Contract F30602-78-C-0102; AF Proj. 2338)
(AD-A088422; RADC-TR-80-139) Avail: NTIS HC A11/MF A01 CSCL 09/3

The application of the Volterra series method for the analysis of circuits with multiple nonlinear elements and multiple multifrequency input sources is described. Using multidimensional transform theory, an approach for deriving the Volterra transfer functions is given. The computation of the sinusoidal steady state response from these transfer functions is presented. Finally, algorithms for adapting the Volterra series method for computer aided steady state analysis of nonlinear circuits are described. A complete documentation of the program PRANC, which uses the Volterra series approach, is also contained in this report. GRA

N80-32667# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
DESIGN, FABRICATION AND EVALUATION OF LOW COST DIODE OSCILLATOR FOR MILLIMETER WAVES
Edmund E. Malecki and Harold Jacobs Apr. 1980 19 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A087954; DELET-TR-80-8) Avail: NTIS HC A02/MF A01 CSCL 09/1

There are urgent requirements for millimeter-wave oscillators in the range of 60 GHz, particularly for local oscillators, receivers, and low power transmit/receive applications such as the self-oscillating mixer. This report describes the design, fabrication and evaluation of a low cost Gunn diode oscillator structure where the diode is placed adjacent to a dielectric waveguide, which in turn, provides output coupling for radiation. Ten milliwatt output power was obtained from a diode at a frequency of 60 GHz. GRA

N80-32668# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Apr. - 30 Sep. 1977
W. Murray Bullis, ed. Aug. 1980 46 p refs Sponsored in part by Navy Strategic Systems Project Office, Defense Nuclear Agency, DOE and Naval Ocean Systems Center
(ARPA Order 2397)
(AD-A088262; NBS-SP-400-45) Avail: NTIS HC A03/MF A01 CSCL 20/12

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Both in-house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period included (1) development of theoretical expressions for computing resistivity and hole mobility for boron-doped silicon; (2) completion of a study of problems associated with use of a scanning electron microscope for total dose testing of semiconductor devices; (3) completion of a pilot study to evaluate procedures for measuring 1 to 10 micrometer wide clear and opaque lines viewed with transmitted illumination; (4) completion of a preliminary study of test structures for estimating densities of process-induced random faults in device wafers; and (5) completion of an interlaboratory evaluation of the destructive wire-bond pull test. Also reported is other ongoing work on materials characterization by electrical and physical analysis methods, materials and procedures for wafer processing, photolithography, test patterns, and device inspection and test procedures. GRA

N80-32669# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
INVESTIGATION OF QUASI-OPTICAL INTEGRATED CIRCUITS AND ELECTROMAGNETIC SCATTERING AND RADIATION PROBLEMS Final Report, 1 Mar. 1977 - 31 May 1980
Raj Mittra Jul. 1980 8 p refs
(Grant DAAG29-77-G-0111)
(AD-A088075; ARO-14686.9-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

A brief summary of a three-year investigation of waveguides, passive components, active circuits and antennas for millimeter waves is presented. Research concentrated entirely on low loss, low cost and lightweight dielectrics that provide an alternative choice to metallic media which become lossy and expensive at millimeter wavelengths. The summary is supplemented by a complete listing of reports and journal publications resulting from the research. GRA

N80-32670# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
A MONOLITHIC GaAs IF AMPLIFIER FOR INTEGRATED RECEIVER APPLICATIONS
D. R. Decker, A. K. Gupta, W. Petersen, and D. R. Chen 1980 18 p refs
(Contract N00014-78-C-0624)
(AD-A088298) Avail: NTIS HC A02/MF A01 CSCL 17/2

A monolithic GaAs integrated amplifier was constructed for the 500 to 1000 MHz intermediate frequency band. The amplifier provides 8.0 + or - 1.5 dB gain across the band. The output of the amplifier utilizes a source follower configuration to obtain a favorably low output VSWR of less than 1.5:1 (return loss = 15 dB). All bias lines with integral bypass capacitors are contained on the chip and this amplifier is suitable for further integration as a building block of a monolithically integrated receiver front end. GRA

N80-32671# Naval Research Lab., Washington, D. C. Antenna Systems Staff.
BUILDING BLOCK FOR AN ORTHONORMAL-LATTICE-FILTER ADAPTIVE NETWORK Interim Report
W. F. Gabriel 10 Jul. 1980 42 p refs
(RR0210101; RR0210541)
(AD-A088088; NRL-8409) Avail: NTIS HC A03/MF A01 CSCL 09/5

The recent algorithm for a multistage multichannel orthonormal lattice filter proposed by M. Aftab Alam is a welcome addition to the library of adaptive-processing algorithms and provides a flexible alternative to the conventional approach of an optimum Weiner filter. This algorithm is based on a Gram-Schmidt orthonormalization procedure which is similar to cascade adaptive processing techniques described in earlier works. One of the most desirable features of this type of processing network is that it can be implemented with simple one-stage orthogonal-filter building blocks which directly filter the input data samples. These building blocks are the major subject of this report, and a particular configuration is developed based on a modified version of the familiar Howells-Applebaum algorithm. It can be implemented in either analog or digital form, data storage is not required, it is unconditionally stable, speed of convergence is no longer a problem, and the design is simple. The performance characteristics of a complete orthogonal-lattice-filter network operating in the spacial domain were simulated for example cases of one, two, and three strong incoherent signal sources spaced within a beamwidth for a eight-element linear-array antenna. The adaptive spacial filter patterns and the transient responses demonstrate that the building block has sufficient transient-response speed and control to permit full use of the processing capabilities inherent in a Gram-Schmidt cascade network. GRA

N80-32672# Polytechnic Inst. of New York, Brooklyn. Microwave Research Inst.
BASIC RESEARCH IN ELECTRONICS, JSEP Final Report, 1 Apr. 1978 - 31 Mar. 1980
Arthur A. Oliner Jun. 1980 87 p refs
(Contract F49620-78-C-0074; AF Proj. 2305)
(AD-A088121; POLY-MRI-1404-80; AFOSR-0620-80TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

Contents: electromagnetics: millimeter wave waveguides and antenna arrays; hybrid ray mode formulation of ducted propagation; wave matter interactions, optical waveguiding structures; solid state electronics: X-ray guided wave electronics; interaction of millimeter waves and semiconductors; acoustoelectric and acoustooptic devices, electric and magnetic interactions in thin

films and surface regions of solids; new solid state materials, electronic properties of hydrogen in solids; information electronics; reduced order models of large scale systems; enhancement, extraction and reconstruction techniques; robust procedures in estimation and detection problems. GRA

N80-32673# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH CONTRAST ELECTROLUMINESCENT READOUT DEVICE Interim Report, 2 Oct. 1978 - 31 Jan. 1979
M. K. Kilcoyne Aug. 1980 35 p refs
(Contract DAAB07-78-C-2996; DA Proj. 1L1-62705-AH-94)
(AD-A088237; ERC41016.91RF; DELET-TR-78-8996-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Rockwell Science Center has completed the first phase of the development program encompassing the design, fabrication, and characterization of experimental models of a high-contrast numeric electroluminescent readout device. This device consists of two digits of seven-segment numeric displays using a transparent electroluminescent thin film with a high-contrast background layer. The device also contains within its hermetically-sealed package, logic and drive circuitry to operate the numeric displays from a typical computer output data processing information, with typical 5 volt T sq L logic level and BCD input. GRA

N80-32674# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
HIGH CONTRAST ELECTROLUMINESCENT NUMERIC READOUT DEVICE Interim Technical Report, 1 Feb. - 31 May 1979
M. K. Kilcoyne Aug. 1980 35 p
(Contract DAAB07-78-C-2996; DA Proj. 1L1-62705-AH-94)
(AD-A088238; ERC41016.1SIRF; DELET-TR-78-2996-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

The Rockwell International Electronics Research Center has completed the second phase of the development program encompassing the design, fabrication, and characterization of experimental models of a high-contrast numeric electroluminescent readout device. This device consists of two digits of seven-segment numeric displays using a transparent electroluminescent thin film with high-contrast background layer. The device also contains within its hermetically sealed package, logic and drive circuitry to operate the numeric displays from a typical computer output data processing information, with five volt T sq L logic level and BCD input. GRA

N80-32675# Varian Associates, Palo Alto, Calif.
ADVANCED AN/TPQ-37 TRANSMITTER TUBE Interim Report, Oct. 1978 - Jun. 1979
R. H. Giebeler Aug. 1980 18 p
(Contract DAAB07-78-C-3007; DA Proj. 1L2-63742-DF-32)
(AD-A088235; DELET-TR-78-3007-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

The purpose of this program is to improve the performance and reliability of the AN/TPQ-37 transmitter tube. The task is to build and test two high power, PPM focused, grid pulsed Traveling Wave Tubes (TWT) that meet the requirements of Technical Guidelines MW-1198. The TWT will employ a M-type cathode for reduced temperature operation and extended life. Gain variations will be minimized by use of in band loss techniques and weight will be reduced by using samarium cobalt magnets. GRA

N80-32676# Army Military Personnel Center, Alexandria, Va.
APPLICATION OF IMAGE INTENSIFIER TECHNOLOGY TO THE MILITARY, SCIENTIFIC, INDUSTRIAL, EDUCATIONAL, AND MEDICAL COMMUNITIES M.S. Thesis Final Report
Patrick H. Orell 30 May 1980 99 p refs
(AD-A088165) Avail: NTIS HC A05/MF A01 CSCL 09/1

This research paper addresses the applications of image intensifier technology to the military, scientific, industrial, educational and medical communities. Image intensifiers are components, that when incorporated into scopes, photographic cameras, television cameras and weapons delivery systems, allow the operator visibility into dark or low illumination areas. The technology has surfaced within the last twenty years and has been, until recently, confined to the military for applications. Image intensified devices are rapidly becoming more popular for various applications, yet many persons are not aware of their existence or potential. The paper is written in non-technical terms to describe the physical make-up of first and second generation Image Intensifiers and addresses the newly developed charged coupled devices and third generation intensifiers under development. It covers a representative sample of applications that have been documented to date by the various manufacturers of Image Intensifiers and the laboratories and agencies that evaluate them. The paper incorporates 37 photographs and illustrations of devices and their applications in support of the communities listed. A list of documented applications and an Image Intensifier tube sensitivity chart is provided for information and reference. GRA

N80-32677# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
THE EFFECT OF VIBRATION ON QUARTZ CRYSTAL RESONATORS
Raymond L. Filler May 1980 40 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A085642; DELET-TR-80-10) Avail: NTIS HC A03/MF A01 CSCL 14/2

The effect of acceleration, particularly vibration, on the frequency of quartz crystal controlled oscillators is described. Simple harmonic motion, complex and random vibrations, and frequency multiplication are covered. Several examples and experiment demonstrations are given. L.F.M.

N80-32678# General Electric Co., Schenectady, N. Y. Electrical Systems and Technology Div.
EVALUATION OF ADVANCED TECHNOLOGIES FOR POWER TRANSFORMERS, PART 1 Final Report, Nov. 1976 - Mar. 1979
S. F. Philip, J. R. Morris, D. K. Bartosh, J. R. Mcloughlin, C. W. Reed, W. F. Westendorp, H. M. Schneider, and E. C. Schrom Jun. 1980 185 p refs 2 Vol.
(Contracts DE-AC01-77ET-29089; EC-77-C-01-2134)
(DOE/RA-2134/01) Avail: NTIS HC A09/MF A01

The feasibility of using the following principal design concept for power transformers was explored: sheet conductors for the windings; a system of sealed, self-contained, annular cooling ducts containing circulating cooling fluid to cool the windings; polymer film for turn-to-turn insulation; and compressed gas insulation. Experimental and analytical studies indicate that the sheet wound, compressed-gas-insulated design should result in power transformers of significantly smaller size and weight when compared with oil-filled units of equivalent rating. These advanced technologies offer the opportunity for the design of more efficient power transformers. DOE

N80-32679# Ames Lab., Iowa.
AC LOSSES IN TYPE-2 SUPERCONDUCTORS
John R. Clem 1979 66 p refs
(Contract W-7405-eng-82)
(IS-M-280) Avail: NTIS HC A04/MF A01

The physics of ac losses in type 2 superconductors and in multifilamentary superconduction normal composite conductors is described. As an introduction, the ac eddy current losses in a homogeneous normal conducting cylindrical specimen subjected to an alternating applied magnetic field are briefly reviewed. The ac losses in a superconducting cylindrical specimen next are discussed in detail, with emphasis on the losses in a specimen subjected to an alternating applied longitudinal magnetic field. In general dissipation occurs via both flux flow losses, which are analogous to eddy current losses in the normal state, and hysteretic losses, which arise from bulk and surface pinning as well as annihilation of vortices of the opposite sense. Tests are suggested by which the dominant loss mechanisms can be identified. Finally, the losses in multifilamentary superconducting normal composite conductors are reviewed. DOE

N80-32680# General Electric Co., Pittsfield, Mass. Power Delivery Technical Resources Operation.
EVALUATION OF ALTERNATIVE INSULATING OILS FOR USE IN TRANSFORMERS AND OTHER ELECTRICAL APPARATUS: CHARACTERISTICS OF INSULATING OILS FOR ELECTRICAL APPLICATION Summary Report

T. O. Rouse Feb. 1980 100 p refs
(EPRI Proj. 562-1)
(EPRI-EL-809-SY) Avail: NTIS HC A05/MF A01

There is a realistic possibility that demand for traditional naphthenic transformer oils will exceed the available supply in the mid 1980's. The results of a program directed toward evaluating alternate fluids are summarized. Oils derived from paraffinic crude sources are predicted to be more plentiful. The results of studies suggest that these paraffinic oils will be satisfactory supplements replacement fluids. Because of the differences in low temperature behavior of the two types of oils, careful consideration must be given to matching a given oil to a given application. DOE

N80-32681# Westinghouse Electric Corp., Sharon, Pa. Materials and Manufacturing Technology Dept.
CHARACTERISTICS OF INSULATING OIL FOR ELECTRICAL APPLICATION Final Report
T. K. Sloat Dec. 1979 303 p refs
(EPRI Proj. 577-1)
(EPRI-EL-1300) Avail: NTIS HC A14/MF A01

Paraffinic crude oils are known to contain significant amounts of wax that, if not removed, could provide an insulating oil having a high pour point which could interfere with the low temperature functioning of most electrical equipment. Because of the wax problem, it was necessary to study the behavior of the paraffinic base insulating oil in representative production size equipment, such as tap changers and power circuit breakers, to be sure that the equipment would operate if exposed to temperatures as low as 40 C. Other studies, such as material compatibility, lubricity of the new oil, arc formed gas, response to dielectric breakdown levels represented in large power transformers, and accelerated aging in distribution transformers, were important to ensure full acceptance of a replacement oil. The work in this project was separated into different phases in order to provide a broad study of the new type of insulating oil. This evaluation of experimental oils indicated that paraffinic transformer oils as a class can provide useful supplements or replacements for naphthenic oils. DOE

N80-32682# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL PROPERTIES OF HIGH-CURRENT MULTIFILAMENTARY Nb3Sn CONDUCTORS
R. M. Scanlan, R. W. Hoard, D. N. Cornish, and J. P. Zbasnik 23 May 1980 13 p refs Presented at the Intern. Cryogenic Mater. Conf., Upton, N.Y., 28-29 May 1980
(Contract W-7405-eng-48)
(UCRL-84040; CONF-800587-1) Avail: NTIS HC A02/MF A01

Nb3Sn is a strain sensitive superconductor which exhibits large changes in properties for strains of less than 1 percent. The critical current density at 12 T undergoes a reversible degradation of a factor of two for compressive strains of about 1 percent and undergoes an irreversible degradation for tensile strains on the Nb3Sn greater than 0.2 percent. One conductor consists of filaments of Nb3Sn in a bronze matrix, and much progress has been made in understanding the mechanical behavior of this composite. The Nb3Sn filaments are placed in compression due to the differential thermal contraction between Nb3Sn and bronze which occurs when the composite is cooled from the Nb3Sn formation temperature (typically 700 C) to the 4.2 K operating temperature. The general behavior of the critical current when this conductor is subjected to a tensile stress is an increase to a maximum when the compressive strain on the Nb3Sn is relieved, followed by a decrease as the Nb3Sn filaments are placed in tension. DOE

N80-32683# Bendix Corp., Kansas City, Mo.
POWER RATINGS OF rf THIN FILM RESISTIVE ATTENUATORS
F. R. Smith Jun. 1980 15 p ref
(Contract DE-AC04-76DP-00613)
(BDX-613-2404) Avail: NTIS HC A02/MF A01

Most radio frequency (rf) assemblies built using hybrid microcircuit technology employ thin film attenuators. These attenuators are subject to moderate rf peak power and to moderate average power. Because of intracircuit mismatch, extra considerations of power requirements must be given. To meet these requirements, selected thin film resistive attenuators operated under large rf power conditions were investigated, and the power margin in which these attenuators can be used was defined. DOE

N80-32684# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A 50 Hz, 250 kV, 500 NS, 500 KW AVERAGE POWER PULSE
Malcolm T. Buttram 1980 6 p refs Presented at the 14th Pulse Power Modulator Symp. Orlando, Fla., 3 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0491C; CONF-800640-8) Avail: NTIS HC A02/MF A01

The development of a 50 Hz research pulser with per shot specifications of 250 kV, 500 ns FWHM, 10 kJ is described. It is designed for burst mode service. The pulser is a two element Guillemin Type C pulse forming network with two parallel Marx generators serving as the first element and a single Marx generator serving as the second element. The two Marx generators of the first element are considered and the important ongoing developmental areas are outlined. DOE

N80-32685# South Carolina Univ., Columbia. High Voltage Lab.
ELECTRO-OPTICAL MEASUREMENTS OF SOLID INSULATOR SURFACE FIELDS AND SURFACE CHARGING IN VACUUM
D. M. Hyslop, J. E. Thompson, and T. S. Sudarshan 21 Apr. 1980 113 p refs
(Grant NB57-89009)
(PB80-192875) Avail: NTIS HC A06/MF A01 CSCL 09A

Electro optical measurements of the electric field along insulator surfaces and in the bulk of insulator materials was made to determine the mechanisms associated with insulator surface flashover. The Pockels effect in KDP was used in conjunction with a polarization interferometer and a pulsed laser to measure interfacial and bulk fields for KDP/vacuum interfaces. The results show that the solid insulator surface and bulk electric field distributions are spatially nonuniform. The electric field at the cathode is considerably enhanced while the field at the anode is reduced. The time evolution and steady state behavior of the insulator electric field distributions for DC, 60 Hz AC, and pulsed excitations are presented. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-32686# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NUMERICAL SOLUTION OF A NONSTEADY BLAST WAVE PROPAGATION IN TWO-PHASE (SEPARATED FLOW) REACTIVE MEDIUM
Shmuel Eidelman and Alexander Burcat Jan. 1980 32 p refs
(TAE-388) Avail: NTIS HC A03/MF A01

The problem of a detonation in a two phase reactive medium is fully solved using the flux corrected transport algorithm (FCT) for an artificial viscosity method. This method is used to solve nonlinear hyperbolic equations of two phase flow and was chosen for its ability to suppress numerical oscillations and to describe complex shock waves. The solution of the problem is described. The details of a test case based on the analytical solution of a strong adiabatic point explosion are given. E.D.K.

N80-32687# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE MECHANISM OF A DETONATION WAVE ENHANCEMENT IN A TWO-PHASE COMBUSTIBLE MEDIUM
Shmuel Eidelman and Alexander Burcat Jan. 1980 25 p refs Presented at the 18th Intern. Combust. Symp.

(TAE-393) Avail: NTIS HC A02/MF A01

The mechanism of the enhancement of a detonation wave in a two phase reactive media was numerically explored. A special algorithm was used in order to differentiate between the numerical and the phenomenological oscillations. The oscillation of the main detonation wave was caused by a set of secondary waves, produced in the reaction zone behind the wave front. The wave length of the secondary waves was found by numerical methods. The graphical presentation of the process provides an overall picture of the mechanism of wave enhancement. E.D.K.

N80-32688*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DEPRIMING OF ARTERIAL HEAT PIPES: AN INVESTIGATION OF CTS THERMAL EXCURSIONS Final Report, Sept. 1978 - Aug. 1980

D. Antoniuk and D. K. Edwards 20 Aug. 1980 214 p refs

(Contract NAS3-21740)

(NASA-CR-165153; TRW-34129-6001-UT-00) Avail: NTIS HC A10/MF A01 CSCL 20D

Four thermal excursions of the Transmitter Experiment Package (TEP) were the result of the depriming of the arteries in all three heat pipes in the Variable Conductance Heat Pipe System which cooled the TEP. The determined cause of the depriming of the heat pipes was the formation of bubbles of the nitrogen/helium control gas mixture in the arteries during the thaw portion of a freeze/thaw cycle of the inactive region of the condenser section of the heat pipe. Conditions such as suction freezeout or heat pipe turn-on, which moved these bubbles into the active region of the heat pipe, contributed to the depriming mechanism. Methods for precluding, or reducing the probability of, this type of failure mechanism in future applications of arterial heat pipes are included. Author

N80-32689*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WIND TUNNEL INVESTIGATION OF THE TITAN FORWARD SKIRT COMPARTMENT VENT FROM A FREE-STREAM MACH NUMBER OF 0.80 TO 1.96

Albert L. Johns Washington Sep. 1980 42 p refs

(NASA-TM-81572; E-541) Avail: NTIS HC A03/MF A01 CSCL 20D

A test was conducted to determine the flow characteristics of the Titan forward skirt compartment vent over a free stream Mach number range of 0.80 to 1.96. The vent was mounted in a flat plate and the plate was flush mounted to the tunnel side wall with coinciding center lines. Air was discharged from a duct, located on the tunnel side wall behind the plate, through a canted aft 30 deg honeycomb vent into the free stream. Data for the analysis of the Titan forward skirt compartment venting during ascent through the atmosphere are provided. Full scale simulated flight hardware, such as the honeycomb vent, duct corrugations and field joint ring were used. Boundary layer thicknesses were used to vary boundary height. The highest vent discharge coefficient for any given Mach number and vent pressure ratio generally occurred at the maximum displacement thickness. With no vent flow the static pressure in the vent region was generally less than the free stream static pressure. With vent flow, the static pressures upstream of the vent increased, and those downstream of the vent decreased. R.K.G.

N80-32690*# Martin Marietta Corp., Denver, Colo.

THERMAL RADIATION ANALYSIS SYSTEM TRASYS 2: USER'S MANUAL

Richard G. Goble and Carl L. Jensen Jun. 1980 214 p Revised 2 Vol.

(Contracts NAS1-15683; NAS9-15304)

(NASA-CR-159273-1; MCR-73-105-1-Rev-2) Avail: NTIS HC A13/MF A01 CSCL 20M

The Thermal Radiation Analyzer System (TRASYS) program put thermal radiation analysis on the same basis as thermal analysis using program systems such as MITAS and SINDA. The user is provided the powerful options of writing his own executive, or driver logic and choosing, among several available options, the most desirable solution technique(s) for the problem at hand. This User's Manual serves the twofold purpose of instructing the user in all applications and providing a convenient reference book that presents the features and capabilities in a concise, easy-to-find manner. T.M.

N80-32691*# Martin Marietta Corp., Denver, Colo.

THERMAL RADIATION ANALYSIS SYSTEM TRASYS 2. APPENDIX H: USER'S MANUAL

Richard G. Goble and Carl L. Jensen Jun. 1980 385 p 2 Vol.

(Contracts NAS1-15683; NAS9-15304)

(NASA-CR-159273-2) Avail: NTIS HC A17/MF A01 CSCL 20M

The user is provided the powerful options of writing his own executive, or driver logic and choosing, among several available options, the most desirable solution techniques for the problem at hand. Sample problems are presented. T.M.

N80-32692*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AEROTHERMAL ANALYSIS OF A WING-ELEVON COVE WITH VARIABLE LEAKAGE

Roane L. Hunt Washington Sep. 1980 44 p refs

(NASA-TP-1703; L-13751) Avail: NTIS HC A03/MF A01 CSCL 20D

A mathematical model of the heating associated with leakage within the space shuttle orbiter wing elevon cove was used to analyze the aerothermal response of the structure. The analysis was applied to wind tunnel results and to shuttle entry conditions. A parametric study described the mechanism by which the energy of the ingested mass is distributed as a function of the Reynolds number, wall conductivity, surface emissivity, and cove height and length. The rate at which energy was transferred into the cove interior was primarily determined by the combined effects of the convection, wall capacitance, and internal radiation terms. Correlation with wind tunnel results indicated that the cold wall convective heating rates, wall temperature, and gas temperature of the cove were predicted by the analytical model for short exposure times. Predicted transient thermal response of the elevon cove subjected to shuttle entry conditions indicated that the allowable leak area at the cove seal was 20 percent less than that previously indicated by experiment. S.F.

N80-32693# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

ON THE THEORY OF FLOW OF REGULAR WATER WAVE ABOUT A BODY

Francis Noblesse Mar. 1980 70 p refs

(Contract N00014-78-C-0169; NR Proj. 062-525)

(AD-A084359; Rept-80-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

Results concerning the integral-equation-Green-function method of solution of the basic linerized problem of potential flow of regular water waves about a body are presented. The main results of the study are: (1) an integral equation for determining the velocity potential, (2) a relatively simple explict approximate solution of this integral equation, and (3) asymptotic expansions, ascending series, and one dimensional Taylor series expansions for efficient numerical evaluation of the Green function. L.F.M.

N80-32694# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.

CHEMICAL REACTIONS IN TURBULENT MIXING Annual Interim Scientific Report, 15 Apr. 1979 - 14 Apr. 1980

H. W. Liepmann, G. L. Brown, P. E. Dimotakis, and A. Roshko 25 Jun. 1980 29 p refs

(Contract F49620-79-C-0159; AF Proj. 2307)

(AD-A088529; GALCIT-151-A; AFOSR-80-0625TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The combustion facility (H2-F2) is now nearing completion. As of this writing, a high speed mixing layer has been realized in the test section, using high pressure air. This certifies the flow facility down to and including the test section. Preliminary results on the effect of high heat release in a turbulent mixing zone were obtained in the NO-O3 experiment. These results are consistent with predictions based on previously measured p.d.f.'s in non-reacting mixing layers, but in conspicuous disagreements with a variety of accepted model calculations. These results demonstrate again the important influence of the large scale

coherent structures on chemical reactions in turbulent flows. The Laser Induced Fluorescence technique has now been extended to allow direct space and time resolved measurements of the reaction products. The first four channels of the multi-channel laser Doppler velocimetry system are essentially completed. The first experiments using this new development are expected in the course of this summer. Digital image analysis of particle streak photography has also been explored as a direct means of two dimensional measurements of the velocity field in a plane. Finally, a prototype system using a 100 element acoustic detector array has been completed. Initial measurements with four of these channels using 300 kHz sound have been successfully made. GRA

N80-32695# Naval Ship Research and Development Center, Bethesda, Md.

BOUNDARY-LAYER FLOW ON AN AXISYMMETRIC BODY WITH AN INFLECTED STERN Final Report

Thomas T. Huang, Nancy C. Groves, and Garnell Belt Aug. 1980 67 p refs

(AD-A088526; DTNSRDC-80/064) Avail: NTIS HC A04/MF A01 CSCL 20/4

Static pressure distributions, mean velocity profiles, distributions of turbulence intensities, and Reynolds stresses, spatial correlation coefficients, and the Taylor microscale of turbulence were measured across the stern boundary layer of an axisymmetric body with an inflected stern. A theoretical and numerical iteration scheme, which uses the boundary layer and open wake displacement body, is found to model satisfactorily the viscid-inviscid interaction between the thick stern boundary layer and the external potential flow. The measured values of turbulence intensity, eddy viscosity, and mixing-length parameters in the stern region are found to be much smaller than those of a thin boundary layer. An approximate similarity characteristic for the thick axisymmetric stern boundary layer is obtained when the measured mixing-length parameters, the measured correlation length scales, and the measured Taylor microscales are normalized by the square root of the boundary-layer cross-sectional area instead of the local boundary layer thickness. When this simple similarity hypothesis for the mixing length and the displacement body is incorporated into the McDonnell Douglas Corp., Cebeci-Smith differential boundary-layer method, modified to consider the displacement body and wake, the theory predicts very well the measured distributions of the mean velocity throughout the entire stern boundary layer. GRA

N80-32696# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER Annual Report, 1 May 1979 - 30 May 1980

D. E. Abbott, C. R. Smith, and J. D. A. Walker May 1980 17 p refs

(Contract F49620-78-C-0071; AF Proj. 2307)

(AD-A088248; AFOSR-80-0567TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

This project combines both experimental video flow visualization studies and theoretical investigations of a series of phenomenological and theoretical models based upon the three dimensional details of convected, coherent structural elements of a turbulent flow as it interacts with a solid surface. The progress over the past year has led to the experimental consideration of range of sub-problems including high Reynolds Number (4,000, 000) turbulent flows, the effect of surface modification on low-speed streak formation, and the effect of vortex loop interaction with a solid boundary. To augment the visualization pictures, a computerized video-digitizing system has been developed. Preliminary results show tremendous promise for obtaining quantitative data from flow visualization pictures. The specific thrust of the theoretical studies has been focussed on three areas: (1) how two and three dimensional vortex structures interact with wall boundary layers, (2) the development of a new type of prediction method for two dimensional turbulent boundary-layer flows, and (3) improvement in numerical techniques for solving parabolic, boundary-layer equations. GRA

N80-32697# Oak Ridge National Lab., Tenn. Energy Div.

FLUOMEG: A PLANAR FINITE DIFFERENCE MESH GENERATOR FOR FLUID FLOW PROBLEMS WITH PARALLEL BOUNDARIES

C. Kleinstreuer (Rensselaer Polytechnic Inst., Troy, N.Y.) and M. R. Patterson May 1980 63 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7115) Avail: NTIS HC A04/MF A01

A two or three dimensional finite difference mesh generator capable of discretizing subrectangular flow regions (planar coordinates) with arbitrarily shaped bottom contours (vertical dimension) was developed. This economical, interactive computer code, written in FORTRAN IV and employing DISSPLA software together with graphics terminal, generates first a planar rectangular grid of variable element density according to the geometry and local kinematic flow patterns of a given fluid flow problem. Then subrectangular areas are deleted to produce canals, tributaries, bays, and the like. For three dimensional problems, arbitrary bathymetric profiles (river beds, channel cross section, ocean shoreline profiles, etc.) are approximated with grid lines forming steps of variable spacing. Furthermore, the code works as a preprocessor numbering the discrete elements and the nodal points. Prescribed values for the principal variables can be automatically assigned to solid as well as kinematic boundaries. DOE

N80-32698# Sandia Labs., Albuquerque, N. Mex.

NUMERICAL SOLUTIONS FOR STEADY THERMAL CONVECTION FROM A CONCENTRATED SOURCE IN A POROUS MEDIUM

C. E. Hickox and H. A. Watts Apr. 1980 53 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-2214) Avail: NTIS HC A04/MF A01

Solutions for the steady, axisymmetric velocity and temperature fields associated with a point source of thermal energy in a fluid saturated porous medium are obtained numerically through use of similarity transformations. A point source located on the lower, insulated boundary of a semi-infinite region and a point source embedded in an infinite region are considered. Numerical results are presented from which complete descriptions of the velocity and temperature fields can be constructed for Rayleigh numbers ranging from 0.001 to 100. DOE

N80-32699# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

HEAT PUMPS IN LOW TEMPERATURE APPLICATIONS

J. G. Keller 18 Aug. 1980 5 p refs Presented at 15th Intersoc. Energy Conversion Engr. Conf., Seattle, 18 Aug. 1980

(Contract DE-AC07-76ID-01570)

(CONF-800806-7) Avail: NTIS HC A02/MF A01

Methods of efficiency using the lower temperature geothermal resources for space conditioning are presented. Water to air and water to water heat pumps for use with domestic or thermally marginal geothermal water in the 50 to 90 F (10 to 32 C) range are examined. Developments in geothermal resource utilization are presented. A diaphragm type heat pump for use with source temperatures as low as 40 C is discussed. DOE

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-32700*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TWO-PHOTON EXCITATION OF NITRIC OXIDE FLUORESCENCE AS A TEMPERATURE INDICATOR IN UNSTEADY GAS-DYNAMIC PROCESSES

R. L. McKenzie and K. P. Gross (Polyatomics Research, Inc., Mountain View, Calif.) Sep. 1980 56 p refs Submitted for publication

(NASA-TM-81220; A-8284) Avail: NTIS HC A04/MF A01 CSCL 14B

A laser induced fluorescence technique, suitable for measuring fluctuating temperatures in cold turbulent flows containing very low concentrations of nitric oxide is described. Temperatures below 300 K may be resolved with signal to noise ratios greater than 50 to 1 using high peak power, tunable dye lasers. The method relies on the two photon excitation of selected ro-vibronic transitions. The analysis includes the effects of fluorescence quenching and shows the technique to be effective at all densities below ambient. Signal to noise ratio estimates are based on a preliminary measurement of the two photon absorptivity for a selected rotational transition in the NO gamma (0,0) band. S.F.

N80-32701*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
ADVANCED VERY HIGH RESOLUTION RADIOMETER, MOD 2 ENGINEERING REPORT Final Report
[1980] 104 p
(Contract NAS5-23400)
(NASA-CR-160034) Avail: NTIS HC A06/MF A01 CSCL 14B

The Advanced High Resolution Radiometer, Mod 2 (AVHRR/2) is a modification of the original AVHRR (AVHRR/1) to expand the number of channels from four to five and provide additional sensing in the infrared region. A comparison of the spectral regions employed in the two instruments is given. Three of the channels are the same on both instruments. The difference in instruments is in the long wave IR region where a single channel was replaced by two channels. The modification from AVHRR/1 to AVHRR/2 was done with a minimum of changes. The areas of change are highlighted and the modifications by module are summarized. It is seen that the primary changes are in the relay optics and in the cooler. In this development program only two models are involved. The first model, the Optical Test Model was constructed and tested to prove the performance and structural integrity of the optical system and the modified cooler. The second model constructed is the Protoflight. Only the areas of the AVHRR/2 which were modified from the AVHRR/1 design are discussed. E.D.K.

N80-32702# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
INVESTIGATION OF PHOTOGRAPHIC IMAGE QUALITY ESTIMATORS
Gilbert G. Kuperman Apr. 1980 112 p refs
(AF Proj. 7184)
(AD-A087805; AFAMRL-TR-80-27) Avail: NTIS HC A06/MF A01 CSCL 14/5

Three predictors of photographic image quality, Inverse Square Law (ISL), Modulation Transfer Function (MTF), and Sun's Equation, were compared against two subjective techniques: Resolving Power (RP) and Visual Image Evaluation (VIE), and five objective techniques: Acutance, Edge Width, Reciprocal Edge Spread (RES), and two MTF/Aerial Image Modulations (MTF/AIM). Triber targets at four nominal contrast levels were photographed while the film plane was driven through 7 1/2 cycles of sinusoidal image motion at seven peak-to-peak displacement amplitudes, 0.00000, (i.e., static), 0.00025, 0.00050, 0.00075, 0.00100, 0.00125, and 0.00150 inches. An analysis of variance (ANOVA) was performed for the RP data. Targets, Amplitudes, and their interaction were found to be highly significant ($p < 0.01$). The independent variables and their interactions accounted for over 96 percent of the total experimental variance. The three predictive models (ISL, MTF, and Sun's Equation) all were highly correlated ($r > 0.96$) linear functions of RP. The VIE technique also proved to be highly linear correlate of RP ($r = 0.95915$). GRA

N80-32703# Naval Research Lab., Washington, D. C. Structural Mechanics Branch.
LIQUID SURFACE LEVITATION HOLOGRAPHY. PART 1: THEORETICAL Interim Report
Alfred V. Clarke, Jr. 11 Aug. 1980 109 p refs
(RR0230345)
(AD-A088418; NRL-8205) Avail: NTIS HC A06/MF A01 CSCL 20/1

The liquid surface levitation holography system has been analyzed, paralleling analyses by previous investigators but treating several new areas. Depth of focus and depth of field of the acoustic lens system are considered, accounting for differences in the acoustic properties of the imaging and object-tank fluids. The mechanical properties of the minitank membrane are shown to have three significant effects: multiple internal reflections of acoustic waves are enhanced in the minitank, which causes the minitank transfer function to become oscillatory for large imaging-fluid depths; deformation of the membrane can degrade the focused acoustic image; and coupling between motions of the membrane and of the liquid surface occurs at low spatial frequencies. Possible coupling between the acoustic field quantities (pressure, density, and velocity) and the surface levitation field is shown to be negligible for a typical system. The low-spatial-frequency deformation (bulge) of the liquid surface is calculated for typical system parameters. The natural frequencies of oscillation of the surface are much less than the rate at which the surface is excited. Consequently the bulge builds up to a steady-state value. GRA

N80-32704# Ampex Corp., Redwood City, Calif. Advanced Technology Div.
RECORDING MEDIA ARCHIVAL ATTRIBUTES (MAGNETIC) Final Technical Report, 30 May 1978 - 30 Nov. 1979
Neal Bertram and A. Eshel Apr. 1980 123 p refs
(Contract F30602-78-C-0181; AF Proj. 3205)
(AD-A088187; RR-80-01; RADC-TR-80-123) Avail: NTIS HC A06/MF A01 CSCL 14/3

This study focuses on the long term (10-15 year) storage effects on magnetic recording media with emphasis on digital magnetic tape. Both the theoretical and experimental aspects are presented covering the primary magnetic, chemical, and mechanical considerations. Definite storage and handling procedures along with an optimum long term magnetic recording system are discussed. Conclusions are that long term storage is possible with magnetic tapes provided tight environmental controls are maintained and low acceleration rewinds are performed at a minimum interval of 3 1/2 years. GRA

N80-32705# American Liquid Xtal Chemical Corp., Kent, Ohio.
NEW INSTRUMENTATION FOR TEMPERATURE MEASUREMENT. PHASE 1: PROGRAM SOLICITATION, SMALL BUSINESS INNOVATION RESEARCH Final Report
James L. Fergason 1980 38 p refs
(Grant NSF DAR-79-17642)
(PB80-184682; NSF/RA-800037) Avail: NTIS HC A03/MF A01 CSCL 14B

Temperature sensitive liquid crystals designed to meet the need for a measuring device to accurately measure temperature and temperature distribution in the presence of electric, magnetic, and sonic fields, especially with high space and thermal resolution are discussed. A technique was developed to make highly reproducible, stable configurations of liquid crystal encapsulates. Temperature stable sensors have been produced which can be calibrated to the National Bureau of Standards. The thermal properties of the liquid crystal can be matched to the properties of the surrounding medium. Since a two dimensional representation of the temperature distribution is possible, the use of this instrumentation has significant implications for bioengineering. GRA

N80-32706# California Univ., Berkeley. Lawrence Berkeley Lab.
BETA GAUGE INSTRUMENTATION FOR THE MEASUREMENT OF AEROSOL MASS Final Report
J. M. Jaklevic, R. C. Gatti, F. S. Goulding, and B. W. Loo May 1980 39 p refs
(PB80-195175; EPA-600/7-80-081) Avail: NTIS HC A03/MF A01 CSCL 14B

An instrument developed for the routine measurement of aerosol mass using the beta gauge particle attenuation method is described and evaluated. Factors affecting the precision and accuracy of the measurement are discussed. Results of intercomparison studies between the beta gauge method and conventional gravimetric are presented. The design of the present instrument is particularly well suited for the automatic analysis of membrane filters obtained from modern dichotomous samplers. GRA

N80-32707# National Technical Information Service, Springfield, Va.

ACOUSTIC HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
William E. Reed Jul. 1980 172 p Supersedes NTIS/PS-70/0735; NTIS/PS-78/0700
(PB80-812530; NTIS/PS-79/0735; NTIS/PS-78/0700) Avail: NTIS HC $30.00/MF $30.00 CSCL 20A

Aspects of acoustic holography are covered in this bibliography of Federally funded research. Theory, equipment design, uses, and imaging techniques are presented. The applications include underwater and underground object locating, structural geology and tectonics, sonar imaging, non destructive testing, antenna radiation patterns, nuclear reactor inspection, remote sensing, and use in medical examination. This updated bibliography contains 166 citations, 15 of which are new entries to the previous edition. GRA

N80-32708# National Technical Information Service, Springfield, Va.
ACOUSTIC HOLOGRAPHY. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
William E. Reed Jul. 1980 334 p Supersedes NTIS/PS-79/0736; NTIS/PS-78/0701
(PB80-812548; NTIS/PS-79/0736; NTIS/PS-78/0701) Avail: NTIS HC $30.00/MF $30.00 CSCL 20A

Worldwide research on acoustic holography is covered. Theory, uses, equipment design, and imaging techniques are presented. Most of the studies are general and not applied to a specific use of acoustic holography. However, there are citations which do discuss its use in medicine, nuclear reactors, and nondestructive testing. This updated bibliography contains 328 citations, 34 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-32709# Aerospace Corp., El Segundo, Calif. Threat Analysis Office.
AUTOMATING THE E-BEAM LASER Interim Report
Raymond G. DeBiase 30 Nov. 1979 26 p
(Contract F04701-79-C-0080)
(AD-A079529; SD-TR-79-10; TR-0080(5940-02)-3) Avail: NTIS HC A03/MF A01 CSCL 20/5

Experiments conducted in the E beam Laser Laboratory require the setting of gas flows, pressures, and voltages in a timed sequence, with a variety of sensors monitoring the system. The report describes the use of a CROMEMCO microcomputer and other hardware, and details a BASIC program that senses and displays process variables digitally, reads in process parameters interactively, acquires data during an experiment, and computes and prints out test conditions and results. Author

N80-32710# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF DISCHARGE PROCESSES IN ELECTRICALLY EXCITED BLUE/GREEN LASERS Final Report, 1 Jun. 1979 - 31 May 1980
Walter J. Wiegand 31 Jul. 1980 48 p refs
(Contract N00014-79-C-0593)
(AD-A087682; UTRC-R80-924780-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

Total and partial cross sections for mercuric bromide (HgBr2) electron attachment and ionization reactions of importance in laser discharges have been measured in electron beam experiments. Corresponding rate coefficients have been determined independently in a pulsed, electron swarm apparatus. These studies have determined that the electron impact ionization cross section of HgBr2 is very large, increasing from a threshold at 10.6 eV to a value of 2 x 10 to the minus 15th power sq cm at 70 eV, with HgBr2 ion being the principal ion formed at low energies. Beam measurements also have revealed only one electron loss process, dissociative attachment. This attachment reaction which produces Br ion has a threshold energy of 3.1 eV and a peak cross section of 1 x 10 to the minus 17th power sq cm at 3.7 eV. From swarm measurements, an attachment rate coefficient of 1.5 x 10 to the minus 10th power cu cm/sec at a few electron volts average electron energy has been determined. This value is consistent with cross section values determined from beam measurements and with values inferred from kinetic modeling studies of electron beam controlled HgBr2 laser discharges. GRA

N80-32711# Naval Research Lab., Washington, D. C.
BEAM NONUNIFORMITY EFFECTS ON LASER ABLATIVELY ACCELERATED TARGETS
S. P. Obenschain, R. H. Lemberg, and B. H. Ripin 20 Aug. 1980 13 p refs
(AD-A088056; NRL-MR-4309) Avail: NTIS HC A02/MF A01 CSCL 18/1

A laser Doppler shift technique gives the velocity profiles of ablatively accelerated targets. Measurements of the effects of laser beam nonuniformity on the target acceleration are presented and interpreted in the context of laser pellet fusion. GRA

N80-32712# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
ADVANCED CONCEPTS IN CLOSED-CYCLE LASERS Final Technical Report, 6 Dec. 1976 - 30 Sep. 1979
Robert A. Olson and Dennis F. Grosjean Wright-Patterson AFB, Ohio Air Force Aero Propulsion Lab. Mar. 1980 187 p refs
(Contract F33615-76-C-2177; AF Proj. 2301)
(AD-A088226; AFWAL-TR-80-2026) Avail: NTIS HC A09/MF A01 CSCL 20/5

The status of closed-cycle-laser technology is reviewed. The technology and performance of closed-cycle lasers in a recirculating loop and in a novel annular-flow-return configuration are discussed. High-repetition-rate laser operation has been achieved in high-pressure mixtures of Ar:Xe, Ne:Xe, He:Xe, He:Kr, He:Ar, and CO2:CO:Xe:He. New laser lines at 5.13 and 5.44 microns have been observed for the He-Xe laser which generated a maximum average laser output power of 5.1 W at 9.5 kHz. Closed-cycle XeCl laser operation employing a recirculating-loop configuration is discussed. Previously measured laser-seeding-agent photoabsorption cross sections and photoionization yields have been verified. Absolute measurements of UV emission from a CO spark source and measurements of UV emission from a CO2:N2:He capillary discharge have been made. A sliding spark and a dielectric-coupled discharge have been investigated as laser-preionizaton sources. Mercury-halide photolytic excitation studies have been made, and HgBr2 photoabsorption cross sections have been measured. GRA

N80-32713# Avco-Everett Research Lab., Mass.
RARE GAS HALIDE LASERS FOR FUSION Final Technical Report, 1 Mar. 1979 - 29 Feb. 1980
C. Duzy, J. Hsia, H. Hyman, J. Jacob, D. Klimek, J. Parks, and D. Trainor Apr. 1980 106 p refs
(Contract DE-AC08-79DP-40103)
Avail: NTIS HC A06/MF A01

In an effort to reliably extend the understanding of KrF lasers, specific, detailed experimental data were collected and theoretical calculations were carried out to explore and document those issues identified as likely to be important in the short pulse operating regime. These included the effects of: (1) fuel burnup, (2) electron quenching, (3) gain/absorption at high current densities, (4) photoionization, (5) accessibility of the lying levels of KrF by laser flux, (6) temperature on fluorescence efficiency. DOE

N80-32714# California Univ., Livermore. Lawrence Livermore Lab.
THERMAL CHARACTERISTICS OF DISCHARGE-HEATED COOPER VAPOR LASER (DHCVL) HEAT SHIELDS FORMED OF MULTIPLE COAXIAL CYLINDERS
T. W. Alger 10 Jan. 1980 8 p refs Presented at the 1974 Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980
(Contract W-7405-eng-48)
(UCRL-83649; CONF-800723-6) Avail: NTIS HC A02/MF A01

A calculational method for predicting the axial temperature variation of each cylinder of a finite length heat shield formed of multiple coaxial cylinders was developed for longitudinal

discharge, discharge heated copper vapor laser (DHCVL) application. This model includes diffuse gray thermal radiation and axial conduction effects, but it neglects radial conduction and convection. Example calculations for three different possible DHCVL geometries (diameters) are presented to demonstrate the importance of emmissivity, number of included cylinders and the applied heat flux on the plasma tube maximum temperature and the axial temperature profile. Comparison is made between a predicted and a measured DHCVL maximum plasma tube temperature. DOE

N80-32715# Los Alamos Scientific Lab., N. Mex.
EXCIMER LASER TECHNOLOGY
Philip N. Mace 1980 9 p refs Presented at 24th SPIE Intern. Symp., San Diego, Calif., 1 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1427; CONF-800810-1) Avail: NTIS HC A02/MF A01

Scaling presently available excimer laser systems to lasers designed to operate at high average power and high pulse repetition rates for long periods of time is addressed. Key technology issues examined include preionization techniques, energy delivery systems, and system chemistry. The development of pulse power components, optical elements, and flow system components is also covered. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-32716* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANT MOTOR DRIVE SYSTEM Patent
John A. Calvert, inventor (to NASA) Issued 5 Aug. 1980 6 p Filed 4 Aug. 1978 Supersedes N78-28460 (16 - 19, p 2534)
(NASA-Case-MFS-23777-1; US-Patent-4,215,592; US-Patent-Appl-SN-931217; US-Patent-Class-74-661; US-Patent-Class-74-425; US-Patent-Class-74-665C; US-Patent-Class-318-15) Avail: US Patent and Trademark Office CSCL 13I

A drive system characterized by a base supporting a pair of pillars arranged in spaced parallelism, a shaft extended between and supported by the pillars for rotation about the longitudinal axis thereof, a worm gear affixed to the shaft and supported in coaxial relation therewith is described. A bearing housing of a sleeve like configuration is concentrically related to the shaft and is supported thereby for free rotation. A first and a second quiescent drive train, alternatively activatable, is provided for imparting rotation into said bearing housing. Each of the drive trains is characterized by a selectively energizable motor connected to a spur gear.
Official Gazette of the U.S. Patent and Trademark Office

N80-32717* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BELT FOR TRANSMITTING POWER FROM A COGGED DRIVING MEMBER TO A COGGED DRIVEN MEMBER Patent
Hossein Bahiman, inventor (to NASA) Issued 5 Aug. 1980 4 p Filed 18 Sep. 1978 Supersedes N78-32435 (16 - 23, p 3086)
(NASA-Case-GSC-12289-1; US-Patent-4,215,590; US-Patent-Appl-SN-943086; US-Patent-Class-474-205; US-Patent-Class-198-847; US-Patent-Class-198-848) Avail: US Patent and Trademark Office CSCL 13I

A belt for transmitting power from a cogged driving member to a cogged driven member such as a pair of wheel sprockets is described. The belt has inflexible teeth spaced along the direction of its travel. Each of the teeth has a longitudinal axis transverse to the direction of belt travel. The belt also includes substantially inextensible fasts spaced transversely to the direction of belt travel. The fasts extend in the direction of belt travel adjacent to the teeth and are looped around preselected numbers of the teeth. Official Gazette of the U.S. Patent and Trademark Office

N80-32718*# Mechanical Technology, Inc., Latham, N. Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING OF ELASTOMERS IN ENGINEERING APPLICATIONS, PART 7
A. Rieger and E. Zorzi Sep. 1980 85 p refs
(Contract NAS3-21623)
(NASA-CR-165138; Rept-80TR63) Avail: NTIS HC A05/MF A01 CSCL 13I

An elastomer shear damper was designed, tested, and compared with the performance of the T 55 power turbine supported on the production engine roller bearing support. The Viton 70 shear damper was designed so that the elastomer damper could be interchanged with the production T 55 power turbine roller bearing support. The results show that the elastomer sheer dampener permitted stable operation of the power turbine to the maximum operating speed of 16,000 rpm. Author

N80-32719*# Chrysler Corp., Detroit, Mich.
UPGRADED AUTOMOTIVE GAS TURBINE ENGINE DESIGN AND DEVELOPMENT PROGRAM, VOLUME 2 Final Report
C. E. Wagner, ed. and R. C. Pampreen, ed. Jun. 1979 348 p refs Sponsored by NASA
(Contracts EY-76-C-02-2749; EC-77-A-31-1040)
(NASA-CR-159671; DOE/NASA/2749-79/2-Vol-2; COO-2749-43-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 13I

Results are presented for the design and development of an upgraded engine. The design incorporated technology advancements which resulted from development testing on the Baseline Engine. The final engine performance with all retro-fitted components from the development program showed a value of 91 HP at design speed in contrast to the design value of 104 HP. The design speed SFC was 0.53 versus the goal value of 0.44. The miss in power was primarily due to missing the efficiency targets of small size turbomachinery. Most of the SFC deficit was attributed to missed goals in the heat recovery system relative to regenerator effectiveness and expected values of heat loss. Vehicular fuel consumption, as measured on a chassis dynamometer, for a vehicle inertia weight of 3500 lbs., was 15 MPG for combined urban and highway driving cycles. The baseline engine achieved 8 MPG with a 4500 lb. vehicle. Even though the goal of 18.3 MPG was not achieved with the upgraded engine, there was an improvement in fuel economy of 46% over the baseline engine, for comparable vehicle inertia weight. Author

N80-32720*# Rochester Inst. of Tech., N. Y.
DEVELOPMENT OF FLEXIBLE ROTOR BALANCING CRITERIA Final Report
Wayne W. Walter and Neville F. Rieger Mar. 1979 115 p refs
(Grant NsG-3072)
(NASA-CR-159506) Avail: NTIS HC A06/MF A01 CSCL 13I

Several studies in which analytical procedures were used to obtain balancing criteria for flexible rotors are described. General response data for a uniform rotor in damped flexible supports were first obtained for plain cylindrical bearings, tilting pad bearings, axial groove bearings, and partial arc bearings. These data formed the basis for the flexible rotor balance criteria presented. A procedure by which a practical rotor in bearings could be reduced to an equivalent uniform rotor was developed and tested. It was found that the equivalent rotor response always exceeded to practical rotor response by more than sixty percent for the cases tested. The equivalent rotor procedure was then tested against six practical rotor configurations for which data was available. It was found that the equivalent rotor method offered a procedure by which balance criteria could be selected for practical flexible rotors, using the charts given for the uniform rotor. A.R.H.

N80-32721# Curtiss-Wright Corp., Wood-Ridge, N.J. Power System Div.
HIGH TEMPERATURE TURBINE TECHNOLOGY PROGRAM, PHASE 2: TECHNOLOGY TEST AND SUPPORT STUDIES Technical Progress Report, 1 Jan. - 31 Mar. 1979
Apr. 1979 140 p
(Contracts EX-76-C-01-2291)

(FE-2291-44A; CW-WR-76-02-0-44A) Avail: NTIS HC A07/MF A01

Objectives of the program elements as well as technical progress and problems associated with coal derived clean fuels are presented. Progress on design, fabrication and checkout of test facilities and test rigs is described. The LP engine test program through 3000 F turbine inlet temperature is discussed. Design and analysis of the TSTR engine and synthesized low Btu gas components are discussed. Supporting materials and process investigations are reviewed. DOE

N80-32722# United Technologies Corp., East Hartford, Conn.
UTRC 8 KW WIND TURBINE TESTS
M. C. Cheney 1980 9 p refs Presented at the Wind Energy Conf., Boulder, Colo., 9 Apr. 1980
(Contract DE-AC04-76DP-03533)
(RFP-3085; CONF-800406-5) Avail: NTIS HC A02/MF A01

The prototype testing demonstrated the basic operation of the unique control concept of the Composite Bearingless Wind Turbine which utilizes a hub mounted pendulum employed to twist the graphite composite inboard region of the blade producing blade pitch variations. The tests also demonstrated the predicted performance of kW at 20 mph, and the high speed stall control feature. DOE

N80-32723# Advanced Mechanical Technology, Inc., Newton, Mass.
DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER GENERATION APPLICATIONS IN THE 500 TO 3000 HORSEPOWER RANGE Quarterly Report
7 Jan. 1980 98 p
(Contract DE-AC02-79ET-15207)
(DOE/ET-15207/T1; QR-1) Avail: NTIS HC A05/MF A01

Factors considered in the generation of state of the art conceptual designs for a Stirling engine capable of being fueled by a variety of heat sources are discussed with emphasis on coal firing. Designs having the the greatest potential for fabrication, testing and demonstration in 1985 are considered as well as advanced technologies which require significant R and D before commercialization. Concepts examined include a heat transport system for integrating the engine heater head with such energy sources as conventional oil gas combustors, fluidized bed and other coal combustors, and combustors using coal derived liquid fuels and low/medium Btu gases. DOE

N80-32724# Massachusetts Inst. of Tech., Cambridge. School of Engineering.
IMPROVEMENT OF RELIABILITY OF WELDING BY IN-PROCESS SENSING AND CONTROL: DEVELOPMENT OF SMART WELDING MACHINES FOR GIRTH WELDING OF PIPES Progress Report
Jose Converti, Yehuda Dror, David E. Hardt, Koichi Masubuchi, Henry M. Paynter, and William C. Unkel 30 Nov. 1979 42 p refs
(Contract DE-AC02-79ER-10474)
(DOE/ER-10474/1; PR-1) Avail: NTIS HC A03/MF A01

Progress in a research program to improve the reliability of welding by developing a smart welding machine is reported. The machine is equipped with sensors, artificial intelligence, and actuators for reducing welding errors by one or two orders of magnitude. DOE

N80-32725# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
ACTIVE FEEDBACK CONTROL FOR STABILIZATION OF VIBRATION IN ROTATING MACHINERY (24.034) Quarterly Technical Report, 1 Apr. - 30 Jun. 1980
Bruce Bakaysa 1980 15 p
(Contract DE-AC01-79ET-13151)
(DOE/ET-13151/T5) Avail: NTIS HC A02/MF A01

Some of the considerations involved in the use of feedback control as a means of reducing the unbalanced response of a rotor or of eliminating or alleviating rotor dynamic instability are discussed. A simple model of a mass on a flexible shaft was used to illustrate the application of feedback control concepts. A description is given of a system which uses feedback control individually adjustable in the vertical and horizontal directions to support the shaft bearings. DOE

N80-32726# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.
WELD OVERLAYING FOR CORROSION RESISTANCE IN COAL GASIFICATION ATMOSPHERES Quarterly Report, 1 Mar. - 31 May 1979
Edward P. Sadowski 1979 65 p
(Contract ET-77-C-01-2621)
(FE-2621-13) Avail: NTIS HC A04/MF A01

Hardness and tensile testing of weldments exposed to a 1% H2S coal gasification atmosphere for 1000 hours at 982 C was completed. Corrosion evaulation of unwelded specimens of 304L, 310 SS and INCOLOY alloy 800H was also completed. The INCONEL Filler Metal 72 and R139 overlays increased and the AWS-ER309 overlays decreased in hardness after exposure. The welding process used had very little effect on the response of the FM-72 overlays, while R139 deposited by the SAW process had the least increase in hardness. The latter may be associated with the lower Al recovery obtained with the SAW process. Generally, the heat affected zone and base metals of all weldments decreased in hardness after exposure. All weldness decreased in room temperature yield and tensile strength after exposure. Most weldments suffered a decrease in tensile ductility. The 310 weldments had the largest percentage decrease and the 304L weldments the last percentage decrease in the original tensile ductility after exposure. DOE

N80-32727# Idaho National Engineering Lab., Idaho Falls.
CENTRIFUGAL PUMP PERFORMANCE UNDER SIMULATED TWO-PHASE FLOW CONDITIONS
Tien-Hu Chen and William J. Quarp 1980 28 p refs Presented at ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC07-76ID-01570)
(CONF-800804-7) Avail: NTIS HC A03/MF A01

Test results from centrifugal (mixed-flow) pump performance testing using nitrogen-water flow to simulate steamwater two phase conditions are presented. Capability of the pump model used to analyze the thermal-hydraulic response when applied to a postulated loss-of-coolant accident in a light water reactor is examined. DOE

N80-32728# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM. OVERALL PLANT DESIGN DESCRIPTION (OPDD) COAL-DERIVED LIQUID
M. W. Horner Mar. 1980 192 p refs
(Contract EX-76-C-01-1806)
(FE-1806-84) Avail: NTIS HC A09/MF A01

A highly reliable, commercially viable system based on coal-derived liquid fuel is described. A coal-derived liquid fueled, high firing temperature, water-cooled gas turbine system with a steam bottoming plant that has one reheat steam turbine is discussed. A detailed exposition of the organization, operation, and control of the integrated system is presented. The combined-cycle system specified provides improved flexibility of operation as well as reliability and efficiency. The PRD-6 gas turbine utilized in the system design has a 12:1 pressure ratio, compressor inlet air flow of 300 lb/second, and a 2600 F deg. firing temperature. The performance characteristics of the overall plant are given. DOE

N80-32729# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
HIGH-TEMPERATURE TURBINE TECHNOLOGY PROGRAM. OVERALL PLANT DESIGN DESCRIPTION (OPDD) LOW-Btu COAL GAS ELECTRIC POWER PLANT
M. W. Horner Mar. 1980 241 p
(Contract EX-76-C-01-1806)
(FE-1806-83) Avail: NTIS HC A11/MF A01

A highly reliable, commercially viable system based on coal derived fuel is described. The system consists mainly of high temperature, water cooled gas turbines that burn coal derived gas fuel, and a steam bottoming cycle with one reheat steam

turbine. The combined cycle system provides improved flexibility of operation as well as reliability and efficiency. DOE

N80-32730# Los Alamos Scientific Lab., N. Mex.
NUMERICAL SIMULATION OF REACTIVE FLOW IN INTERNAL COMBUSTION ENGINES
L. D. Cloutman, J. K. Dukowicz, and J. D. Ramshaw 1980 7 p refs Presented at 7th Intern. Conf. on Numerical Methods in Fluid Dyn., Palo Alto, Calif. 23-27 Jun. 1980; sponsored by NASA and Stanford Univ. Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-1633; CONF-800661-1) Avail: NTIS HC A02/MF A01

Multidimensional numerical simulations of the reactive fluid flow in an internal combustion engine cylinder are useful in helping engine designers obtain insight into the physical mechanism governing efficiency and pollutant formation. A comprehensive numerical model for internal combustion engine cylinder simulations is described. The model is currently embodied in a two dimensional (axisymmetric) computer code called CONCHAS-SPRAY. Work is in progress on a three dimensional code with the same features. DOE

N80-32731# Brookhaven National Lab., Upton, N. Y.
SOOT REDUCTION IN DIESEL ENGINES BY CATALYTIC EFFECTS
R. Sapienza, T. Butcher, C. Krishna, and J. Gaffney 1980 20 p refs Presented at 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980; sponsored by EPA
(Contract DE-AC02-76CH-00016)
(BNL-27792; CONF-800553-2) Avail: NTIS HC A02/MF A01

Small additions of alcohols to the fuel and the presence of platinum surfaces in the combustion chamber can reduce soot emissions in a diesel engine. Tests were conducted over a limited range of operation in a single cylinder CFR engine. Most of the testing was done using pure cetane as a fuel at constant speed and load. Possible major features of the reaction mechanisms for both fuel additives and surface catalyst effectiveness are presented. DOE

N80-32732# Central Inst. for Industrial Research, Oslo (Norway).
CERAMIC COATINGS ON DIESEL ENGINE COMPONENTS Progress Report, Jan. - Aug. 1979
Ingard Kvernes and Karl Peter Lillend Oct. 1979 19 p refs
(Contract DE-AC03-79ET-15320)
(DOE/ET-15320/T1) Avail: NTIS HC A02/MF A01

The development and testing of ceramic coatings for diesel engine components are discussed. These coatings include oxides of Al, Cr, Zr, Mg, Si, Ti, and Ca, and Mo and Ch carbides. Data on their application and thermodynamic and wear characteristics are presented. Preliminary results show that, relative to valves and piston crowns: stabilized ZrO2 coating under certain conditions increases the working life of various components; higher combustion temperature may improve the thermal efficiency by increased turbocharger air delivery; reduction in the component temperatures decreases the thermal stresses; the ZrO2.MgO shows improved corrosion resistance in combustion gases compared to (ZrO2)(Y2O3) and (ZrO2)(CaO); the limitations of the coatings must be defined in more detail; and the adherence of thicker coatings must be improved. Optimization of the spraying process with respect to particle fusion is necessary. Also, Mo and Ch carbide coatings were found to increase the service life of piston rings. DOE

N80-32733# Porsche (Ferdinand) AG, Stuttgart (West Germany).
REDUCTION OF FUEL CONSUMPTION BY THERMODYNAMIC OPTIMIZATION OF THE OTTO MOTOR: COMPARATIVE INVESTIGATION OF OTTO DIESEL ENGINES
D. Gruden, R. Hahn, and H. Loercher 1980 171 p refs In GEORGIAN
(EUR-6711-DE) Avail: NTIS (US Sales Only)HC A08/MF A01; DOE Depository Libraries

Test on a 2 l Otto engine for the Porshe 924 demonstrate that by optimizing the compression ratio, combustion chamber shape, fuel air ratio and ignition timing, it is possible to reduce the fuel consumption over the entire load and speed range from 4 to 30% in comparison with the conventional variant, without losing maximum power output. The compression ratio of the new engine is 13.0, and is operated with lean fuel/air mixture in the part load range. The acceleration time from 0 to 100 km/h is 9.7 s for the Otto variant, and 24.7 s for the diesel engine. The fuel consumption of both variants is about identical in mixed traffic conditions (city, road, highway). Exclusively in city driving (ECE-test) the diesel engine has a 9% better fuel consumption than the Otto engine due to its lower idle fuel consumption. At higher speeds (90 and 120 km/h), the fuel consumption of the thermodynamically optimized Otto engine is 2 to 8% lower. DOE

N80-32734# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF DIESEL ENGINE, 1979 SUMMARY SOURCE DOCUMENT Final Report
Thomas Trella Mar. 1980 166 p refs Sponsored by National Highway Traffic Safety Administration 5 Vol.
(PB80-193659; DOT-TSC-NHTSA-79-38; DOT-HS-805130) Avail: NTIS HC A08/MF A01 CSCL 21E

The fuel economy potential of diesel engines in future passenger cars and light trucks was assessed. The primary technologies evaluated included: engine control strategy and implementation, the engine design variables, emissions and noise, fuels, lubricants, vehicle-engine matching, and the effects of vehicle characteristics. The major findings are summarized. GRA

N80-32735# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF DIESEL ENGINE, EMISSION TECHNOLOGY Final Report
Joseph Sturm and Thomas Trella Mar. 1980 47 p refs Sponsored by National Highway Traffic Safety Administration 5 Vol.
(PB80-192685; DOT-TSC-NHTSA-79-40; DOT-HS-805239) Avail: NTIS HC A03/MF A01 CSCL 21E

Diesel engine emission technologies applicable to passenger cars and light trucks were surveyed. The general design and operating features are presented and discussed. Current and state-of-the-art concepts were reviewed with the focus on control of diesel emissions through modification of the combustion process, aftertreatment systems and fuel modifications. GRA

N80-32736# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF SPARK IGNITION ENGINE, EFFECT OF VEHICLE DESIGN VARIABLES ON TOP SPEED, PERFORMANCE, AND FUEL ECONOMY Final Report
Ralph W. Zub, Carol M. Neckyfarow, William M. Lew, and Ralph G. Colello Mar. 1980 86 p refs Sponsored by National Highway Traffic Safety Admistration 4 Vol.
(PB80-191836; DOT-TSC-NHTSA-79-53; DOT-HS-805133) Avail: NTIS HC A05/MF A01 CSCL 21E

The effect of vehicle characteristics on vehicle performance and fuel economy was evaluated. Computer simulation offers repeatability and can predict minute changes in fuel economy based on relatively small vehicle alterations. The degree to which each vehicle parameter is modified is based upon projections presented in current literature. The results are assessed and an explanation of the interaction of the vehicle design characteristics on performance is presented. GRA

N80-32737# Transportation Systems Center, Cambridge, Mass.
POTENTIAL OF SPARK IGNITION ENGINE, 1979 SUMMARY SOURCE DOCUMENT Final Report, FY 1979
T. Trella, Ralph W. Zub, and Ralph G. Colello Mar. 1980 208 p refs Sponsored by National Highway Traffic Safety Administration. 4 Vol.
(PB80-191034; DOT-TSC-NHTSA-79-52; DOT-HS-805132) Avail: NTIS HC A10/MF A01 CSCL 21E

An assessment of the potential for spark ignition engines passenger cars and light trucks is provided. The assessment includes tradeoffs between fuel economy and emissions; improvements in spark ignition engine efficiency; improvements in engine parasitics; improvements due to transmissions; effect of aerodynamic drag and the rolling resistance on fuel economy; effect on performance and fuel economy of weight and axle ratio; lubricant improvements; impact of fuels; and noise considerations. GRA

N80-32738# Scientific Process and Research, Inc., Highland Park, N. J.

ON-LINE DIRECT DIGITAL CONTROL EXTRUSION PROCESS
Imrich Klein and Reuben Klein 4 Apr. 1980 102 p refs
(Grant NSF DAR-79-17508)
(PB80-186489; NSF/RA-800052) Avail: NTIS HC A06/MF A01 CSCL 13H

Evaluation of existing extrusive control systems in the plastics industry and analysis of a new method of control are discussed. The term extrusion control system in relation to plastics processing operations includes set point controls for various types of heating and cooling equipment as well as motor speed controls for dc and hydraulic screw drives for digital and microprocessor based electronic systems, machine sequencers for injection and blow molding lines, and feed back loops for sheet thickness and insulation uniformity. The extrusion process is examined: the extrusion operation, analysis of existing control systems, directions for development of a new control system, program modules and linkages, and the alarm handler operation. GRA

N80-32739# Amex Systems, Inc., Hawthorne, Calif.
MINI ARC WELDING/BRAZING TECHNIQUE Final Report
G. L. Cann 31 Mar. 1980 68 p refs
(Grant NSF DAR-79-17748)
(PB80-186497; AMEX-0407; NSF/RA-800048) Avail: NTIS HC A04/MF A01 CSCL 13H

Feasible applications of the mini-arc technique to competitive electron beam welding, or spot welding are described. This involved establishing the physical principles and processes which occur in all methods of making metal-to-metal or metal-to-ceramic joints. The mini-arc welder precludes the need for flux or other chemical cleaning processes. It operates on several selected materials and configurations. Results were compared to those using electron beam and spot welding. The mini-arc proved superior, sometimes creating welds which other techniques could not match. The mini-arc technique can reduce fabrication costs for selected materials and it is ideally suited for automation in manufacturing processes, especially those involving small dimensions. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-32740# Aeronautical Research Labs., Melbourne (Australia).
WEATHERING TESTS ON PROTECTIVE HELMETS APPROVED TO AUSTRALIAN STANDARD AS 1698, FOR VEHICLE USERS Interim Report
S. R. Sarrailhe and G. A. Thomas Nov. 1979 23 p refs Sponsored by DOT
(AD-A084232; ARL/STRUC-TM-306; AR-001-773; IR-1) Avail: NTIS HC A02/MF A01 CSCL 06/17

The methodology to be used to investigate the effect of weathering on the performance of protective (crash) helmets approved to Australian Standard AS 1698 is described. The results of the preexposure inspections and tests are also provided. R.K.G.

N80-32741# California Univ., Berkeley. Operations Research Center.
ACCELERATED LIFE TESTS AND INFORMATION Research Report
Richard E. Barlow Jun. 1980 20 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A088014; ORC-80-14) Avail: NTIS HC A02/MF A01 CSCL 14/2

This is a partly philosophical discussion of the problems of conducting accelerated life test experiments and analyzing data from such experiments. Our objective is to predict life at a specified stress level. The concept of information is presented and its quantification via entropy discussed. GRA

N80-32742# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
NONPARAMETRIC EMPIRICAL BAYES ESTIMATION OF RELIABILITY Interim Report
K. Y. Liang and W. J. Dadgett May 1980 14 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088182; TR-58; AFOSR-80-0587TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several sequences of nonparametric empirical Bayes estimators of a distribution (or reliability) function are considered. Their asymptotic optimality relative to a Dirichlet process prior is investigated, and the estimators are compared for a small number of stages with respect to Weibull distributions by computer simulation. GRA

N80-32743# Lockheed-California Co., Burbank.
AVAILABILITY/OPERATIONAL READINESS TEST SUBSYSTEM COST TRADEOFFS Final Technical Report
Richard M. Loveless May 1980 106 p refs
(Contract F30602-78-C-0179; AF Proj. 2338)
(AD-A088201; RADC-TR-80-182) Avail: NTIS HC A06/MF A01 CSCL 15/5

This report describes the general test subsystem practices and tradeoff criteria that will make it possible for an equipment's or system's availability (or operational readiness) requirements to be met through the most cost effective usage of fault diagnosis/isolation/test subsystems that are used in conjunction with the maintenance of the equipment. The trade-off criteria are intended for use in planning the acquisition of new equipments and systems and to provide more accurate assessment of total life-cycle cost. GRA

N80-32744# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
RELIABILITY CONSIDERATIONS OF ELECTRONICS COMPONENTS FOR THE DEEP UNDERWATER MUON AND NEUTRINO DETECTION SYSTEM
Branko Leskovar Feb. 1980 20 p refs Presented at the Process Workshop, Honolulu, 11-16 Feb. 1980
(Contract W-7405-eng-48)
(LBL-10548; CONF-800240-1) Avail: NTIS HC A02/MF A01

The reliability of some electronics components for the Deep Underwater Muon and Neutrino Detection (DUMAND) System is discussed. An introductory overview of engineering concepts and technique for reliability assessment is given. Component reliability is discussed in the context of major factors causing failures, particularly with respect to physical and chemical causes, process technology and testing, and screening procedures. Failure rates for discrete devices and for integrated circuits as well as for basic electronics components are presented. The military reliability specifications and standards for semiconductor devices are reviewed. DOE

N80-32745# California Univ., Livermore. Lawrence Livermore Lab. Materials Engineering Div.
WELD EVALUATION ON SPHERICAL PRESSURE VESSELS USING HOLOGRAPHIC INTERFEROMETRY
Donald M. Boyd and William W. Wilcox 14 May 1980 16 p refs Presented at the Fourth Intern. Congr. on Exptl. Mechs., Boston, 26-30 May, 1980
(Contract W-7405-eng-48)
(UCRL-84079; CONF-800575-2) Avail: NTIS HC A02/MF A01

Waist welds on spherical experimental pressure vessels were evaluated under pressure using holographic interferometry. A coincident viewing and illumination optical configuration coupled with a parabolic mirror was used so that the entire weld region could be examined with a single hologram. Positioning the pressure vessel at the focal point of the parabolic mirror provides a relatively undistorted 360 degrees of view of the waist weld. Double exposure and real time holography were used to obtain displacement information on the weld region. Results are compared with radiographic and ultrasonic inspections. DOE

N80-32746# California Univ., Livermore. Lawrence Livermore Lab. Materials Engineering Div.
HOLOGRAPHIC AND ACOUSTIC EMISSION OF EVALUATION OF PRESSURE VESSELS
Donald M. Boyd 5 Mar. 1980 7 p refs Presented at the

ASME Centennial PUP Conf., San Francisco, 12-15 Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84046; CONF-800804-5) Avail: NTIS HC A02/MF A01

Optical holographic interferometry and acoustic emission monitoring were simultaneously used to evaluate two small, high pressure vessels during pressurization. The techniques provide pressure vessel designers with both quantitative information such as displacement/strain measurements and qualitative information such as flaw detection. The data from the holographic interferograms were analyzed for strain profiles. The acoustic emission signals were monitored for crack growth and vessel quality. DOE

N80-32747# Bendix Corp., Kansas City, Mo. Technical Communications Div.
AUTOMATIC VISUAL INSPECTION OF HYBRID MICROCIRCUITS Final Report
R. E. Hines May 1980 98 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2359) Avail: NTIS HC A05/MF A01

An automatic visual inspection system using a minicomputer and a video digitizer was developed for inspecting hybrid microcircuits (HMC) and thin film networks. The system performed well in detecting missing components on HMCs and reduced the testing time for each HMS by 7 percent. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-32748# Army Materials and Mechanics Research Center, Watertown, Mass. Engineering Mechanics Div.
SCATTERED LIGHT PHOTOELASTIC ANALYSIS OF A PROJECTILE BULKHEAD TO STRUCTURAL CASE JOINT Final Report
Miloslav Benicek and Jiro Adachi Oct. 1979 16 p
(DA Proj. 1X4-64603-D-663)
(AD-A079563; AMMRC-TR-79-54) Avail: NTIS HC A02/MF A01 CSCL 20/11

Photoelastic stress analysis of the bulkhead to structural case pin joint of a projectile was carried out using the scattered light technique. Analysis provided three dimensional stress distributions in critical areas of the joint including the pinhole, pin bearing surfaces, and joint bearing surfaces. Stress gradients through the wall were found to be large; however, stress concentrations were found to be moderate with a maximum value of 3.7.
Author

N80-32749# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THEORETICAL STUDIES OF COLUMNS UNDER AXIAL IMPACT AND EXPERIMENTAL VERIFICATION
J. Ari-Gur, T. Weller, and J. Singer Aug. 1979 47 p refs
(TAE-377) Avail: NTIS HC A03/MF A01

The response of clamped columns, axially impacted by a mass, is studied. Rayleigh type beam equations and nonlinear strain displacement relations are assumed for linear-elastic anisotropic materials. The equations are solved by a finite difference approximation, the choice of mesh sizes is discussed, and recommendations for best discretization are given. Comparisons of the results with experiments and with some available analytic results show good correlation. Dynamic buckling criteria are discussed and buckling strains are determined for various columns. The overall response of a column is represented by a relation which yields a dynamic Southwell type relation. A dynamic amplification load factor (DLF) is defined, and parametric studies show that this factor is primarily dependent upon initial geometrical imperfection of the column, its effective slenderness, and the duration of the impulsive loading. E.D.K.

N80-32750# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ON THE CONSTITUTIVE LAWS FOR THE LARGE STRAIN CYLINDRICAL DEFORMATIONS OF SHELLS
Avinoam Libai and J. G. Simmonds (Virginia Univ.) May 1979 30 p refs
(TAE-370) Avail: NTIS HC A03/MF A01

Expressions are developed for the strain energy and stress resultants in the case of large strain-large bending cylindrical deformations of shells of nonlinear materials. The deformation variables are the extension and curvature of the material reference surface. The Mooney material is used as an example where appropriate. The influence of the large deformations on the constitutive laws is evaluated. Of special interest is the effect of cross terms and of the ability to express the stress resultants as partial derivatives of the strain energy with respect to appropriate deformation variables. Author

N80-32751# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
FRACTURE TOUGHNESS TESTING OF HDPE PLASTIC PIPE
Peter Flueeler (Swiss Federal Labs. for Testing Materials and Research, Duebendorf), Daniel R. Roberts, John F. Mandell, and Frederick J. McGarry Nov. 1979 30 p refs Sponsored by Agency for International Development
(MIT-CE-R79-5) Avail: NTIS HC A03/MF A01

A program to investigate the applicability of fracture toughness test methods to high density polyethylene pipe is described. Fracture toughness test specimens cut from pipe material were tested in a precracked three point bending test at different rates. The load vs crack opening displacement record was used in an attempt to judge the validity of the test and to determine the fracture load. This method appears to need further development for this class of materials as the results were difficult to interpret. Use of the maximum force for tests which appeared to fail in a quasi-brittle manner resulted in calculation of a fracture toughness value. This value was used to predict the burst pressure of pipes containing surface cracks in the longitudinal direction. The prediction of burst pressure was slightly conservative, but in agreement with the trend of the experimental results. Fractographic analysis indicates three modes of crack propagation: ductile, quasi-brittle, and brittle. Author

N80-32752*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STATISTICAL ENERGY ANALYSIS OF COMPLEX STRUCTURES, PHASE 2 Final Report
R. W. Trudell and L. I. Yano Sep. 1980 78 p refs
(Contract NAS8-33191)
(NASA-CR-161576; MDC-G9203) Avail: NTIS HC A05/MF A01 CSCL 20K

A method for estimating the structural vibration properties of complex systems in high frequency environments was investigated. The structure analyzed was the Materials Experiment Assembly, (MEA), which is a portion of the OST-2A payload for the space transportation system. Statistical energy analysis (SEA) techniques were used to model the structure and predict the structural element response to acoustic excitation. A comparison of the intial response predictions and measured acoustic test data is presented. The conclusions indicate that: the SEA predicted the response of primary structure to acoustic excitation over a wide range of frequencies; and the contribution of mechanically induced random vibration to the total MEA is not significant.
F.O.S.

N80-32753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE METHOD OF LINES IN THREE DIMENSIONAL FRACTURE MECHANICS
John Gyekenyesi and Laszlo Berke Washington 1980 19 p refs Presented at the Intern. Symp. on Absorbed Specific Energy and/or Strain Energy Density Criterion, Budapest, 17-19 Sep. 1980; sponsored by Lehigh Univ. and the Hungarian Acad. of Sci.
(NASA-TM-81593; E-576) Avail: NTIS HC A02/MF A01 CSCL 20K

A review of recent developments in the calculation of

design parameters for fracture mechanics by the method of lines (MOL) is presented. Three dimensional elastic and elasto-plastic formulations are examined and results from previous and current research activities are reported. The application of MOL to the appropriate partial differential equations of equilibrium leads to coupled sets of simultaneous ordinary differential equations. Solutions of these equations are obtained by the Peano-Baker and by the recurrance relations methods. The advantages and limitations of both solution methods from the computational standpoint are summarized. R.K.G.

N80-32754*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTERLAMINAR STRESS SINGULARITIES AT A STRAIGHT FREE EDGE IN COMPOSITE LAMINATES
I. S. Raju (George Washington Univ.) and John J. Crews, Jr. Aug. 1980 31 p refs
(Grant NsG-1449)
(NASA-TM-81876) Avail: NTIS HC A03/MF A01 CSCL 20K

A quasi three dimensional finite element analysis was used to analyze the edge stress problem in four-ply, composite laminates. Convergence studies were made to explore the existence of stress singularities near the free edge. The existence of stress singularities at the intersection of the interface and the free edge is confirmed. S.F.

N80-32755# Materials Research Labs., Ascot Vale (Australia).
DATA CONTROLLER SYSTEM FOR FATIGUE CRACK MONITORING USING A POTENTIAL DROP TECHNIQUE
Barry J. Baxter 1979 22 p ref
(MRL-TN-429; AR-001-839) Avail: NTIS HC A02/MF A01

A control unit is described which was designed to interface with (1) a digital voltmeter calibrated to respond to fatigue crack growth, (2) load and cycle data from a servo hydraulic system, and (3) a desk calculator. The calculator is programmed to determine crack length, crack growth rate and stress intensity factors. Preset limits on the load and number of cycles permits termination of the test when the levels have been exceeded. Appropriate power supplies for the units are also discussed. A.R.H.

N80-32756*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESEARCH IN NONLINEAR STRUCTURAL AND SOLID MECHANICS
Harvey G. McComb, Jr., comp. and Ahmed K. Noor, comp. (Joint Inst. for Advancement of Flight Sciences, Hampton, Va.) 1980 287 p refs Symp. on Computational Methods in Nonlinear Struct. and Solid Mech. held in Washington, D.C., 6-8 Oct. 1980; sponsored by NASA, George Washington Univ., NSF, ASCE and ASME
(NASA-CP-2147; L-13950) Avail: NTIS HC A13/MF A01 CSCL 20K

Nonlinear analysis of building structures and numerical solution of nonlinear algebraic equations and Newton's method are discussed. Other topics include: nonlinear interaction problems; solution procedures for nonlinear problems; crash dynamics and advanced nonlinear applications; material characterization, contact problems, and inelastic response; and formulation aspects and special software for nonlinear analysis. For individual titles, see N80-32757 through N80-32776.

N80-32757*# Rijkswaterstaat, The Hague (Netherlands).
ANALYSIS OF REINFORCED CONCRETE STRUCTURES WITH OCCURRENCE OF DISCRETE CRACKS AT ARBITRARY POSITIONS
J. Blaauwendraad, H. J. Grooteniboer, A. L. Bouma (Technische Hogeschool, Delft, Netherlands), and H. W. Reinhardt (Technische Hogeschool, Delft, Netherlands) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 1-12 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A nonlinear analysis of in-plane loaded plates is presented, which eliminates the disadvantages of the smeared crack approach. The elements used and the computational method are discussed. An example is shown in which one or more discrete cracks are dominant. E.D.K.

N80-32758*# University Coll. of Swansea (Wales).
COMPUTATIONAL MODELS FOR THE NONLINEAR ANALYSIS OF REINFORCED CONCRETE PLATES
E. Hinton, H. H. Abdel Rahman, and M. M. Huq *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 13-26 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A finite element computational model for the nonlinear analysis of reinforced concrete solid, stiffened and cellular plates is briefly outlined. Typically, Mindlin elements are used to model the plates whereas eccentric Timoshenko elements are adopted to represent the beams. The layering technique, common in the analysis of reinforced concrete flexural systems, is incorporated in the model. The proposed model provides an inexpensive and reasonably accurate approach which can be extended for use with voided plates. E.D.K.

N80-32759*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NEWTON'S METHOD: A LINK BETWEEN CONTINUOUS AND DISCRETE SOLUTIONS OF NONLINEAR PROBLEMS
Gaylen A. Thurston *In its* Res. in Nonlinear Struct. and Solid Mech. 1980 p 27-46 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Newton's method for nonlinear mechanics problems replaces the governing nonlinear equations by an iterative sequence of linear equations. When the linear equations are linear differential equations, the equations are usually solved by numerical methods. The iterative sequence in Newton's method can exhibit poor convergence properties when the nonlinear problem has multiple solutions for a fixed set of parameters, unless the iterative sequences are aimed at solving for each solution separately. The theory of the linear differential operators is often a better guide for solution strategies in applying Newton's method than the theory of linear algebra associated with the numerical analogs of the differential operators. In fact, the theory for the differential operators can suggest the choice of numerical linear operators. In this paper the method of variation of parameters from the theory of linear ordinary differential equations is examined in detail in the context of Newton's method to demonstrate how it might be used as a guide for numerical solutions. Author

N80-32760*# Electric Power Research Inst., Palo Alto, Calif.
NONLINEAR SOIL-STRUCTURE INTERACTION CALCULATIONS SIMULATING THE SIMQUAKE EXPERIMENT USING STEALTH 2D
H. T. Tang, R. Hofmann (Science Applications, Inc., San Leandro, Calif.), G. Yee (Science Applications, Inc., San Leandro, Calif.), and D. K. Vaughan (Weidlinger Associates, Menlo Park, Calif.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 47-66 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Transient, nonlinear soil-structure interaction simulations of an Electric Power Research Institute, SIMQUAKE experiment were performed using the large strain, time domain STEALTH 2D code and a cyclic, kinematically hardening cap soil model. Results from the STEALTH simulations were compared to identical simulations performed with the TRANAL code and indicate relatively good agreement between all the STEALTH and TRANAL calculations. The differences that are seen can probably be attributed to: (1) large (STEALTH) vs. small (TRANAL) strain formulation and/or (2) grid discretization differences. E.D.K.

N80-32761*# Akron Univ., Ohio. Dept. of Civil Engineering.
COMBUSTION: STRUCTURAL INTERACTION IN A VISCOELASTIC MATERIAL
T. Y. Chang, J. P. Chang, M. Kumar (Pennsylvania State Univ., University Park), and K. K. Kuo (Pennsylvania State Univ., University Park) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 67-90 refs (For primary document see N80-32756 23-39)
(Contract N00014-79-C-0762)
Avail: NTIS HC A13/MF A01 CSCL 20K

The effect of interaction between combustion processes and structural deformation of solid propellant was considered. The

combustion analysis was performed on the basis of deformed crack geometry, which was determined from the structural analysis. On the other hand, input data for the structural analysis, such as pressure distribution along the crack boundary and ablation velocity of the crack, were determined from the combustion analysis. The interaction analysis was conducted by combining two computer codes, a combustion analysis code and a general purpose finite element structural analysis code. E.D.K.

N80-32762*# North Texas State Univ., Denton. Dept. of Mathematics.
ITERATIVE METHODS BASED UPON RESIDUAL AVERAGING
J. W. Neuberger *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 91-96 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

Iterative methods for solving boundary value problems for systems of nonlinear partial differential equations are discussed. The methods involve subtracting an average of residuals from one approximation in order to arrive at a subsequent approximation. Two abstract methods in Hilbert space are given and application of these methods to quasilinear systems to give numerical schemes for such problems is demonstrated. Potential theoretic matters related to the iteration schemes are discussed. E.D.K.

N80-32763*# Science Applications, Inc., San Leandro, Calif.
COMPUTATIONAL STRATEGY FOR THE SOLUTION OF LARGE STRAIN NONLINEAR PROBLEMS USING THE WILKINS EXPLICIT FINITE-DIFFERENCE APPROACH
R. Hofmann *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 97-114 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The STEALTH code system, which solves large strain, nonlinear continuum mechanics problems, was rigorously structured in both overall design and programming standards. The design is based on the theoretical elements of analysis while the programming standards attempt to establish a parallelism between physical theory, programming structure, and documentation. These features have made it easy to maintain, modify, and transport the codes. It has also guaranteed users a high level of quality control and quality assurance. Author

N80-32764*# Akron Univ., Ohio.
SELF-ADAPTIVE INCREMENTAL NEWTON-RAPHSON ALGORITHMS
Joseph Padovan *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 115-127 refs (For primary document see N80-32756 23-39)
(Grant NAG3-54; Contract N00014-78-C-0691)
Avail: NTIS HC A13/MF A01 CSCL 20K

Multilevel self-adaptive Newton-Raphson type strategies are developed to improve the solution efficiency of nonlinear finite element simulations of statically loaded structures. The overall strategy involves three basic levels. The first level involves preliminary solution tunneling via primative operators. Secondly, the solution is constantly monitored via quality/convergence/nonlinearity tests. Lastly, the third level involves self-adaptive algorithmic update procedures aimed at improving the convergence characteristics of the Newton-Raphson strategy. Numerical experiments are included to illustrate the results of the procedure. E.D.K.

N80-32765*# Oklahoma State Univ., Stillwater.
STUDY OF SOLUTION PROCEDURES FOR NONLINEAR STRUCTURAL EQUATIONS
Clive T. Young, II and Rembert F. Jones, Jr. (Naval Ship Research and Development Center, Washington, D.C.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 129-139 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

A method for the redution of the cost of solution of large nonlinear structural equations was developed. Verification was made using the MARC-STRUC structure finite element program with test cases involving single and multiple degrees of freedom for static geometric nonlinearities. The method developed was designed to exist within the envelope of accuracy and convergence characteristic of the particular finite element methodology used. E.D.K.

N80-32766*# Old Dominion Univ., Norfolk, Va.
RESPONSE OF NONLINEAR PANELS TO RANDOM LOADS
Chuh Mei *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 141-163 refs (For primary document see N80-32756 23-39)
(Contract F49620-79-C-0016)
Avail: NTIS HC A13/MF A01 CSCL 20K

Lightweight aircraft structures exposed to a high intensity noise environment can fatigue prematurely if adequate consideration is not given to the problem. Design methods and design criteria for sonic fatigue prevention were developed based on analytical and experimental techniques. Most of the analytical work was based upon small deflection or linear structural theory which did not agree with the experimental results. A large deflection geometrical nonlinearity was incorporated into the analysis methods for determining the structural response to high intensity noise. The Karman-Herrmann large deflection equations with a single mode Galerkin approximation, and the method of equivalent linearization were used to predict mean square amplitude, mean square stresses, and nonlinear frequency at various acoustic loadings for rectangular panels. Both simply supported and clamped support conditions with immovable or movable inplane edges are considered. Comparisons with experimental results are presented. E.D.K.

N80-32767*# Battelle Columbus Labs., Ohio.
POST-BUCKLING BEHAVIOR OF A BEAM-COLUMN ON A NONLINEAR ELASTIC FOUNDATION WITH A GAP
Edward N. Kuznetsov and Thomas G. Johns (Battelle Houston Operations, Tex.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 165-173 refs Sponsored by American Gas Association Pipeline Research Committee (For primary document see N80-32756 23-39)
Avail: NTIS CSCL 20K

The structural behavior of an elastic beam-column placed with a gap between two nonlinearity elastic layers each resting on a rigid foundation was examined. The beam-column was laterally supported at both ends and subjected to a uniform transverse load and axial compression. Its slenderness was such that the axial compressive force exceeds the amount that would be necessary to buckle it as a simple supported column. The elastic layers were represented by an elastic foundation with a strongly nonlinear specific reaction taken as a rapidly increasing function of the layer compression. The analytical model developed simulated the entire pattern of the deflection and stress state including layer and end support reactions, under gradually increasing axial force. R.C.T.

N80-32768*# Linz (Austria).
STRAIGHTENING OF A WAVY STRIP: AN ELASTIC-PLASTIC CONTACT PROBLEM INCLUDING SNAP-THROUGH
Dieter F. Fischer and Franz G. Rammerstorfer *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 175-185 refs (For primary document see N80-32756 23-39)
Avail: NTIS HC A13/MF A01 CSCL 20K

The nonlinear behavior of a wave like deformed metal strip during the levelling process were calculated. Elastic-plastic material behavior as well as nonlinearities due to large deformations were considered. The considered problem lead to a combined stability and contact problem. It is shown that, despite the initially concentrated loading, neglecting the change of loading conditions due to altered contact domains may lead to a significant error in the evaluation of the nonlinear behavior and particularly to an underestimation of the stability limit load. The stability was examined by considering the load deflection path and the behavior of a load-dependent current stiffness parameter in combination with the determinant of the current stiffness matrix. R.C.T.

N80-32769*# Kansas State Univ., Manhattan. Dept. of Civil Engineering.

A PROPOSED GENERALIZED CONSTITUTIVE EQUATION FOR NONLINEAR PARA-ISOTROPIC MATERIALS

K. K. Hu, S. E. Swartz, and C. J. Huang *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 187-196 refs (For primary document see N80-32756 23-39)

(Grant NSF ENG-78-07829)

Avail: NTIS HC A13/MF A01 CSCL 20K

Finite element models of varying complexities were used to solve problems in solid mechanics. Particular emphasis was given to concrete which is nonisotropic at any level of deformation and is also nonlinear in terms of stress-strain relationships. R.C.T.

N80-32770*# Goodrich (B. F.) Co., Akron, Ohio.

FINITE ELEMENT ANALYSIS OF HYPERELASTIC STRUCTURES

Farhad Tabaddor *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 197-209 refs (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

The use of the penalty function, to account for near incompressibility is discussed and compared to that of Lagrange multiplier. A scheme to use Lagrange multiplier, without having to treat it as unknown, is also presented. R.C.T.

N80-32771*# System Development Corp., Santa Monica, Calif.

SOLUTIONS OF CONTACT PROBLEMS BY THE ASSUMED STRESS HYBRID MODEL

Kenji Kubomura and Theodore H. H. Pian (MIT, Cambridge) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 211-224 refs (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

A method was developed for contact problems which may be either frictional or frictionless and may involve extensive sliding between deformable bodies. It was based on an assumed stress hybrid approach and on an incremental variational principle for which the Euler's equations of the functional include the equilibrium and compatibility conditions at the contact surface. The tractions at an assumed contact surface were introduced as Lagrangian multipliers in the formulation. It was concluded from the results of several example solutions that the extensive sliding contact between deformable bodies can be solved by the present method. R.C.T.

N80-32772*# Ecole Polytechnique Federale de Lausanne (Switzerland).

FINITE ELEMENTS FOR CONTACT PROBLEMS IN TWO-DIMENSIONAL ELASTODYNAMICS

Thomas K. Zimmermann and Wing Kam Liu (California Inst. of Tech., Pasadena) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 225-235 refs (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

A finite element approach for contact problems in two dimensional elastodynamics was proposed. Sticking, sliding, and frictional contact were taken into account. The method consisted of a modification of the shape functions, in the contact region, in order to involve the nodes of the contacting body. The formulation was symmetric (both bodies were contactors and targets), in order to avoid interpenetration. Compatibility over the interfaces was satisfied. The method was applied to the impact of a block on a rigid target. It is shown that the formulation can be applied to fluid structure interaction, and to problems involving material nonlinearity. R.C.T.

N80-32773*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

INELASTIC BEHAVIOR OF STRUCTURAL COMPONENTS

Noor Hussain, K. Khozeimeh, and T. G. Toridis *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 237-250 refs (For primary document see N80-32756 23-39)

(Grant NSF PFR-79-16263)

Avail: NTIS HC A13/MF A01 CSCL 20K

A more accurate procedure was developed for the determination of the inelastic behavior of structural components. The actual stress-strain curve for the mathematical of the structure was utilized to generate the force-deformation relationships for the structural elements, rather than using simplified models such as elastic-plastic, bilinear and trilinear approximations. relationships were generated for beam elements with various types of cross sections. In the generational of these curves, stress or load reversals, kinematic hardening and hysteretic behavior were taken into account. Intersections between loading and unloading branches were determined through an iterative process. Using the inelastic properties obtained, the plastic static response of some simple structural systems composed of beam elements was computed. Results were compared with known solutions, indicating a considerable improvement over response predictions obtained by means of simplified approximations used in previous investigations. R.C.T.

N80-32774*# Ecole Polytechnique Federale de Lausanne (Switzerland).

NONLINEAR FINITE ELEMENT ANALYSIS: AN ALTERNATIVE FORMULATION

Silvio Merazzi and Peter Stehlin (Aeronautical Research Inst. of Sweden, Stockholm) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 251-261 refs Sponsored in part by Swiss National Science Foundation and National Swedish Board for Energy Source Development (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

A geometrical nonlinear analysis based on an alternative definition of strain is presented. Expressions for strain are obtained by computing the change in length of the base vectors in the curvilinear element coordinate system. The isoparametric element formulation is assumed in the global Cartesian coordinate system. The approach is based on the minimization of the strain energy, and the resulting nonlinear equations are solved by the modified Newton method. Integration of the first and second variation of the strain energy is performed numerically in the case of two and three dimensional elements. Application is made to a simple long cantilever beam. Author

N80-32775*# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

COROTATIONAL VELOCITY STRAIN FORMULATIONS FOR NONLINEAR ANALYSIS OF BEAMS AND AXISYMMETRIC SHELLS

Ted Belytschko, H. Stolarski (Polish Academy of Sciences, Warsaw), and C. S. Tsay *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 263-276 refs Sponsored by Electric Power Research Inst. (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

Finite element formulations for large strain, large displacement problems are formulated using a kinematic description based on the corotational components of the velocity strain. The corotational components are defined in terms of a system that rotates with each element and approximates the rotation of the material. To account for rotations of the material relative to this element system, extra terms are introduced in the velocity strain equations. Although this formulation is incremental, in explicitly integrated transient problems it compares very well with formulations that are not. R.C.T.

N80-32776*# Tokyo Univ. (Japan).

MICROCOMPUTER SYSTEM FOR MEDIUM-SIZED AND EXPERIMENTAL FINITE ELEMENT ANALYSIS

Yoshiaki Yamada, Hideto Okumura, and Tatsumi Sakurai (Japan Advanced Numerical Analysis, Inc.) *In* NASA. Langley Research Center Res. in Nonlinear Struct. and Solid Mech. 1980 p 277-289 refs (For primary document see N80-32756 23-39)

Avail: NTIS HC A13/MF A01 CSCL 20K

The development of a microcomputer system is described. A series of finite element analysis programs are evaluated in terms of their cost effective application within the microcomputer system. It is shown that the system is practically maintenance free and can be sustained by individual laboratories of standard scale in the educational or academic environment. R.C.T.

N80-32777*# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.

DYNAMIC MODAL ESTIMATION USING INSTRUMENTAL VARIABLES
H. Salzwedel Jul. 1980 66 p refs
(Contract NAS2-10339)
(NASA-CR-152396; TR-6419-01) Avail: NTIS HC A04/MF A01; CSCL 20K

A method to determine the modes of dynamical systems is described. The inputs and outputs of a system are Fourier transformed and averaged to reduce the error level. An instrumental variable method that estimates modal parameters from multiple correlations between responses of single input, multiple output systems is applied to estimate aircraft, spacecraft, and off-shore platform modal parameters. E.D.K.

N80-32778# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SHEAR STRAINS, STRAIN RATES AND TEMPERATURE CHANGES IN ADIABATIC SHEAR BANDS
Gerald L. Moss May 1980 31 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A087765; AD-E430477; ARBRL-TR-02242) Avail: NTIS HC A03/MF A01 CSCL 20/11

Experiments were conducted to determine the shear strains and strain rates in adiabatic shear bands in a Ni-Cr steel (rolled armor). An explosively driven mass was used to punch plugs from plate of the steel and, thereby, create adiabatic shear bands. There were originally planes of chemical inhomogeneity (reference bands) in the plane of the steel samples. The slopes of the reference bands were altered by the plastic shear, and they were, therefore, a measure of the plastic shear strain. From measurements of the slopes of the reference bands, it was found that the plastic shear was approximately an exponential function of distance through an adiabatic shear band. Shear strains of at least 572 developed after the onset of adiabatic shear. The results suggest how heating occurs within the shear bands, the maximum temperatures attained and the related strength degradation associated with the development of an adiabatic shear band. GRA

N80-32779# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
A COMPARISON OF RESIDUAL STRESS MEASURING TECHNIQUES: THEIR STRENGTHS AND WEAKNESSES
Fred M. Witt, Fee M. Lee, and Walter M. Rider Aug. 1980 30 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A088409; AD-E400457; ARSCD-SP-80001) Avail: NTIS HC A03/MF A01 CSCL 20/12

Ongoing inhouse work on the measurement of residual stress in Army Material by both X-ray and strain gage mechanical relaxation methods is presented and compared. The X-ray portion includes problems associated with the calculation of stresses in highly textured samples while the strain gage portion describes effects produced by various mechanical methods to partially relieve the strain fields sensed by the active gage elements. Comparisons are also made of the errors introduced by considering the active element in the strain gage rosette as a point gage instead of one with finite length. GRA

N80-32780# Texas Engineering Experiment Station, College Station. Aerospace Engineering Dept.
A SURVEY OF CURRENT TEMPERATURE DEPENDENT ELASTIC-PLASTIC-CREEP CONSTITUTIVE LAWS FOR APPLICABILITY TO FINITE ELEMENT COMPUTER CODES Interim Report
David H. Allen 31 May 1980 41 p refs
(Contract N00014-78-C-0150)
(AD-A088375; TEES-3275-80-2) Avail: NTIS HC A03/MF A01 CSCL 20/11

The volume of the research effort currently under way to characterize the constitution of thermoelastic plastic creep materials is ample evidence of its importance. Although significant work has been done to obtain working constitutive models, in many cases the theory has not been cast with the remaining field equations into a working continuum model. In this paper, the author will consider models from classical plasticity and nonlinear viscoelasticity theory for applicability to the conservation of momentum. Based on physical accuracy as well as computational efficiency the author will assess the feasibilty of further development of each model. GRA

N80-32781# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
A VOID GROWTH FAILURE CRITERION APPLIED TO DYNAMICALLY AND STATICALLY LOADED THIN RINGS
A. M. Rajendran and I. M. Fyfe Jun. 1980 55 p refs
(Grant DAAG29-77-G-0211)
(AD-A088515; Rept-80-10; ARO-15078.1-E) Avail: NTIS HC A04/MF A01 CSCL 13/5

The introduction of inertia terms in the theoretical model of thin ring expansion shows that classical plastic instability concepts, defined in terms of the local strain in the necking region, no longer apply. However, in this report it is shown that, when the plastically incompressible constitutive model is replaced with a model applicable to porous plastic materials, a criterion based on critical void volume fraction provides an alternative means to predict failure. The theory also provides a method in which both geometric and metallurgical imperfections in a given sample might be considered. The application of this theory to thin ring specimens was used to confirm that the critical void growth concept predicts the uniform strain at failure as observed in aluminum and copper rings, under both quasi-static and high strain-rate loading conditions. GRA

N80-32782# Materials Research Labs., Ascot Vale (Australia).
A HIGH-SENSITIVITY POTENTIAL-DROP TECHNIQUE FOR FATIGUE CRACK GROWTH MEASUREMENTS
Graham Clark Aug. 1979 40 p refs
(AD-A088278; MRL-R-755; AR-001-837) Copyright. Avail: NTIS HC A03/MF A01 CSCL 20/11

This report describes the design features of a highly sensitive and accurate system for monitoring the growth of fatigue cracks in laboratory specimens of various geometries. The system is based on the potential drop method which utilizes the electrical resistance changes associated with fatigue crack growth through the specimen cross section to detect crack length increments of a few micrometers. The technique is suitable for automation, and tests may be completed with a minimum amount of operator interference. A computer based data processing method is described, and the performance of the system in measuring both absolute crack length and crack growth rate is evaluated. GRA

N80-32783# Southwest Research Inst., San Antonio, Tex.
CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIGUE Interim Report, Jun. 1979 - Jun. 1980
D. L. Davidson and J. Lankford 31 Jul. 1980 51 p refs
(Contract N00014-75-C-0138)
(AD-A087961; SWRI-02-4268) Avail: NTIS HC A04/MF A01 CSCL 11/6

The effects of a water vapor environment on crack tip plasticity in low-carbon steel have been further examined. Strains in the plastic zone, as determined by stereoimaging, have been used to compute stresses at the same locations, and an estimate of the energy expended for creation of new crack area may also be computed using the same strains. These values are compared with similar information derived previously using plastic zone subgrain size distributions as determined by electron channeling. There is general agreement between the data determined by the two techniques. A model is offered for including the effects of water vapor upon crack tip plasticity into the damage accumulation analysis of fatigue crack propagation. A critical discussion is also given of the findings to date on the effects of environment on crack tip plasticity, and it is concluded that those findings may be explained by changes in the material properties very close to the crack tip, rather than in the bulk of the plastic zone. GRA

N80-32784# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC MIXED MODE FRACTURE Interim Report
A. S. Kobayashi and M. Ramulu Aug. 1980 14 p refs
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A088287; TR-39) Avail: NTIS HC A02/MF A01 CSCL 20/11

A newly developed data reduction process was used to re-evaluate dynamic photoelastic results and to extract dynamic stress intensity factors, K(I)dyn and K(II)dyn, associated with curved and branched cracks in fracturing Homalite-100 plates. A branching stress intensity factor approximately 5 times the fracture toughness was identified for this material. Moderate to severe crack curvings were associated with a K(I)dyn and K(II)dyn ratio as low as 0.05, but with positive remote stress component, sigma (ox). GRA

N80-32785# Queens Coll., Flushing, N. Y.
MOLECULAR DYNAMIC SHOCK WAVE STUDIES IN SOLIDS, FRACTURE AND CRACK PROPAGATION Final Report, 27 Sep. 1976 - 31 Jun. 1980
Arthur Paskin 31 Jun. 1980 4 p
(Grants DAAG29-76-G-0337; DAAG29-77-G-0223)
(AD-A088335; ARO-14444.2-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

The earlier computer simulations of shock waves in solids was completed. An equation of state for shock waves in solids was developed and found to be an accurate description of shock wave properties. Computer simulation techniques were also used to study fracture and crack propagation in solids. The basic assumptions made in the usual continuum mechanics calculations were examined and found to be at best approximate. Some interesting results were found for rapidly applied stresses. GRA

N80-32786# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Mechanics.
THE ANALYSIS AND DESIGN OF CONSTRAINED LAYER DAMPING TREATMENTS Technical Report, Apr. - Jun. 1980
Peter J. Torvik Jul. 1980 64 p refs
(AD-A088200; AFIT-TR-80-4) Avail: NTIS HC A04/MF A01 CSCL 20/11

A tutorial work in which the mechanisms by which large shear strain may be induced in a damping layer are explored. The parameters of the system which determine the effectiveness of constrained layer treatments are identified from analyses of several geometric configurations. Advances of the past two decades in the design and analysis of damping layers as a means of controlling the amplitude of resonant vibrations are reviewed. GRA

N80-32787# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A PHOTOELASTOPLASTIC STUDY OF STRESS CONCENTRATION FACTORS AND RESIDUAL STRESSES IN TWO NOTCHED SPECIMENS OF POLYCARBONATE MATERIAL
Y. F. Cheng May 1980 30 p refs
(AD-A088538; AD-E440084; ARLCB-TR-80025) Avail: NTIS HC A03/MF A01 CSCL 20/11

A photoelastoplastic study on stress concentrations, in elastic as well as in elastoplastic states, in a C-shaped specimen and a compact tensile specimen of polycarbonate material has been made. The principles of the experimental method are outlined, equations for nominal stresses are given, and stress concentration factors are determined. Residual stresses after unloading are calculated by making the usual assumption that unloading is an elastic process. In the elastic state, stress concentration factors are readily applicable to specimens of any material with similar geometry and loading. In the elastoplastic state, it requires the similarity of stress strain relation between model and prototype materials. GRA

N80-32788# Sandia Labs., Albuquerque, N. Mex. Experimental Planning Div.
PUFF TOO: A RESIDUAL STRESS EXPERIMENT
Carl W. Smith Apr. 1980 85 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1674) Avail: NTIS HC A05/MF A01

Following the passage of the dynamic effects in a contained explosive detonation, there remains a strong compressive stress field in the material about the cavity. In this experiment, a 454 kg (1000 lb) sphere of high explosive was detonated in saturated ashfall tuff. Instrumentation measured peak stresses over the range of 0.1 to 6.0 GPa (1 to 6 Kbar) and the complete stress-time waveform, including the so-called residual stress, at the 0.1 GPa (1 kbar) peak stress range. Mineback revealed detonation-induced fractures and fractures induced by postevent work. DOE

N80-32789# Brookhaven National Lab., Upton, N. Y.
BENDING BEHAVIOR OF LAPPED PLASTIC EHV CABLES
G. H. Morgan and A. C. Muller 1980 6 p refs Presented at 1980 Intern. Symp. on Elec. Insulation, Boston, 9-11 Jun. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27331) Avail: NTIS HC A02/MF A01

One of the factors delaying the development of lapped polymeric cables was their reputed poor bending characteristics. Complementary programs were begun several years ago to mathematically model the bending of synthetic tape cables and to develop novel plastic tapes designed to have moduli more favorable to bending. A series of bend tests was recently completed to evaluate the bending performance of several tapes developed for use in experimental superconducting cables. The program is discussed and the results of the bend tests are summarized. DOE

N80-32790# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
MEAN WIND FORCES ON PARABOLIC-TROUGH SOLAR COLLECTORS
J. A. Peterka (Colorado State Univ.), J. M. Sinau (Colorado State Univ.), and J. E. Cermak (Colorado State Univ.) May 1980 121 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7023) Avail: NTIS HC A06/MF A01

Characteristics of mean wind loads produced by airflow in and around several configurations of parabolic trough solar collectors with and without a wind fence are discussed. Four basic parabolic shapes were investigated as single units and one shape was studied as part of several array fields. One scale model of each parabolic shape was constructed for mounting on a force balance to measure two forces and three moments. The effects of several dominant variables were investigated in this study: wind-azimuth (or yaw), trough elevation (or pitch) angle, array field configuration, and protective wind fence characteristics. All measurements were made in a boundary layer flow. DOE

N80-32791# Oak Ridge National Lab., Tenn. Computer Sciences Div.
APPROXIMATION OF FINITE ELEMENT NODAL POINT STRESSES FOR NONLINEAR MATERIAL MODELS
B. R. Bass, W. G. Johnson, and S. V. McGrath 28 Feb. 1980 44 p refs
(Contract W-7405-eng-26)
(K/TS-3798) Avail: NTIS HC A03/MF A01

A computational scheme is described for approximating elastic-plastic stress components at the nodal points of finite element grids. The method is based on a local least squares smoothing technique and a well known incremental plasticity model. During each load step of the materially nonlinear analysis, strain values at the Gauss integration points are extrapolated to the nodes; the incremental change in strains at the nodes is then determined from previously stored nodal strain values. The increment in nodal stresses is calculated from the incremental elastic-plastic stress-strain relations for the nodes and added to the nodal stresses computed in the previous update. An application of the scheme to the analysis of a thin bellows under compressive loading is discussed; the results are compared with those obtained from using a different nodal stress technique. DOE

N80-32792# Sandia Labs., Albuquerque, N. Mex.
FINITE ELEMENT ANALYSIS FOR THE INITIATION OF LAMELLAR TEARING IN WELDED JOINTS
Raymond D. Krieg and Robert K. Thomas 1980 23 p refs Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC04-76DP-00789; AT(29-1)-789)
(SAND-79-1891C; CONF-800804-10) Avail: NTIS HC A02/MF A01

A numerical procedure using the finite element method is presented for predicting the initiation of lamellar tearing in fillet welded T-joints commonly employed in large structures. Starting with a prescribed geometry, the welding process is approximated by a known time dependent volumetric heat source which simulates the arc heating and deposition of liquid metal. The transient nonlinear thermal and stress problems are then solved using finite element computer codes. Results of the elastic-plastic stress analysis are presented showing a predicted region of incipient lamellar tearing based on a ductile fracture theory which qualitatively agrees with the size and location of tears typically observed in photomicrographs. Additional insight into post failure crack length and stability is presented based on a simplified linear elastic fracture mechanics approach. Although the analysis procedure shows signs of promise, several weak points in the model are pointed out which must be improved before lamellar tearing can be quantified in an approach of this general type. DOE

N80-32793# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.

CONSISTENT STRESS-STRAIN DUCTILE FRACTURE MODEL AS APPLIED TO TWO GRADES OF BERYLLIUM

T. G. Priddy, S. E. Benzley, and L. M. Ford 1980 46 p refs

(Contracts DE-AC04-76DP-00789; AT(29-1)-789)

(SAND-79-2126) Avail: NTIS HC A03/MF A01

Published yield and ultimate biaxial stress and strain data for two grades of beryllium are correlated with a more complete method to characterizing macroscopic strain at fracture initiation in ductile materials. Results are compared with those obtained from an exponential, mean stress dependent model. Simple statistical methods are employed to illustrate the degree of correlation for each method with the experimental data. DOE

N80-32794# Los Alamos Scientific Lab., N. Mex.

PLASTIC DEFORMATION OF COLLIDING HEMISHELLS

David C. Mair and Timothy R. Neal 1980 13 p ref Presented at the Intern. Conf. on the Met. Effects of High Strain-Rate Deformation and Fabric., Albuquerque, N. Mex., 22-26 Jun. 1980

(Contract W-7405-eng-36)

(LA-UR-80-1659; CONF-800641-4) Avail: NTIS HC A02/MF A01

The collision of two hemishells is analyzed where one hemishell is clamped and the other impinges on the inner surface of the clamped hemishell. A model of rigid perfectly plastic behavior is proposed for the flow of material in the region of contact. An expression relating velocity and deformation is obainted and compared with the results of experiments. DOE

N80-32795# Sandia Labs., Albuquerque, N. Mex.

TECHNIQUE FOR THE GENERATION OF PRESSURE-SHEAR LOADING USING ANISOTROPIC CRYSTALS

J. W. Swegle and L. D. Chhabildas 1980 15 p refs Presented at the Intern. Conf. on the Met. Effects of High Strain Rate Deformation and Fabrication, Albuquerque, N. Mex., 22 Jun. 1980

(Contract DE-AC04-76DP-00789)

(SAND-80-1301C; CONF-800641-2) Avail: NTIS HC A02/MF A01

In the investigation, Y-cut quartz crystals are used as pressure-shear generators, and X-cut quartz and 6061-T6 aluminum are used as test specimens. The coupled longitudinal and shear motion generated within the Y-cut crystal can be transmitted into a test specimen bonded to the rear surface of the crystal, and monitored using velocity interferometer techniques. Experiments on X-cut quartz and 6061-T6 aluminum demonstrate applicability of the technique. Results obtained in this investigation are compared with numerical solutions using the finite difference wave propagation code TOODY. DOE

N80-32796# Wyoming Univ., Laramie. Energy Technology Center.

NEW METHOD TO DETERMINE THE INDEPENDENT SHEAR MODULI OF TRANSVERSELY ISOTROPIC MATERIALS

K. P. Chong, J. L. Chen, K. Uenishi, and J. W. Smith 1980 15 p refs Presented at the 4th SESA Intern. Congr. on Exptl. Mech., Boston, 25-30 May, 1980

(Contract DE-AT20-80LC-10224)

(CONF-800575-1) Avail: NTIS HC A02/MF A01

A simple method is presented to determine the independent shear moduli of transversely isotropic materials. The method is tested on Green River Formation oil shale, one of such materials. The method is applicable for linear and nonlinear elastic materials. Mathematical formulation, derivation and solution are given, and test apparatus and results are presented. Comparison with other approximate results and acoustical methods are made. Confirmation of the test method with materials having known shear moduli is also presented. DOE

N80-32797# California Univ., Livermore. Lawrence Livermore Lab.

TECHNIQUE FOR STUDYING MULTIPLE FRACTURES PRODUCED AT INTERMEDIATE LOADING RATES

R. P. Swift and A. S. Kusubov 4 Apr. 1980 18 p refs Presented at the Rock Mech. Symp., Rolla, Mo., 28-30 May 1980

(Contract W-7405-eng-48)

(UCRL-83653; CONF-800507-6) Avail: NTIS HC A02/MF A01

A laboratory experimental technique was developed to study the effects of pressurizing the borehole of rock samples with tailored pulses at intermediate loading rates. The experimental apparatus provides sample confinement to 50 Mpa pressure, borehole pressures up to 200 MPa with loading rates from 0.01 to 100 MPa/ms, and pulse durations on the order of 1 to 50 ms. Observations from tests on a dense quartz sandstone under ambient confinement of 0.1 MPa are as follows: for static loading with oil, the breakdown pressure is about 21 MPa and two fractures oriented at 180 deg. are produced; for loadings with water at rates of about 10 MPa/ms, the breakdown pressure increases to about 30 MPa and multiple fractures are created; and for loading rates between 50 to 90 MPa/ms, the breakdown pressure increases to 35 MPa and there is an increase in the number of initiated fractures. DOE

N80-32798# Battelle Pacific Northwest Labs., Richland, Wash.

DEVELOPMENT OF ULTRASONIC TOMOGRAPHY FOR RESIDUAL STRESS MAPPING Final Report

A. J. Boland, T. J. Davis, S. R. Doctor, T. P. Harrington, B. P. Hildebrand, D. K. Lemon, G. J. Posakony, and J. R. Skorpik May 1980 82 p refs

(Contract DE-AC06-76RL-01830; EPRI Proj. 504-2)

(EPRI-NP-1407) Avail: NTIS HC A05/MF A01

The volumetric stress distribution in nuclear reactor piping and pressure vessels is becoming an increasingly important parameter in nondestructive evaluation. Research and development of instrumentation leading toward a means of measuring subsurface stress distributions in metals is described. Based on the principles of computerized tomography, an ultrasonic tomographic instrument uses an ultrasonic linear array to acquire time of flight data to an accuracy of 0.5 to 1.0 ns. The data are processed using a modified algebraic reconstruction technique program. A two dimensional map of the velocity distribution is displayed on a monitor. The velocity distribution is interpreted or calibrated in terms of stress through the acousto elastic coefficients. DOE

N80-32799# California Univ., Livermore. Lawrence Livermore Lab.

USING THE ACOUSTOELASTIC EFFECT TO MEASURE STRESS IN PLATES

Davis M. Egle 5 Mar. 1980 27 p refs

(Contract W-7405-eng-48)

(UCRL-52914) Avail: NTIS HC A03/MF A01

Use of longitudinal ultrasonic waves for measuring the sum of the principal stresses in welded plates was investigated. A cross-correlation technique for measuring the time delay between two successive echoes was developed and shown to be capable of a precision of 10 ps. Stress measurements in a double cantilever beam and a disk and annulus specimen show good agreement with calculated values. DOE

N80-32800# Bendix Corp., Kansas City, Mo. Communication Services.

PLATED-THROUGH HOLE TESTING Final Report

W. B. Abel May 1980 55 p
(Contract DE-AC04-76DP-00613)
(BDX-613-2424) Avail: NTIS HC A04/MF A01

An improved microresistance testing method to measure the thickness of copper plating in plated-through holes of double sided printed wiring boards is presented. A new probe design, combined with a microprocessor controller, makes it possible for a direct reading tester to provide variables data. Tester design and software programs for the system are included. Results of correlation studies, comparing the improved resistance method to cross sectional measurements are presented. Limitations on the microresistance test method are discussed. DOE

N80-32801# Bendix Corp., Kansas City, Mo. Technical Communication Div.
FINITE ELEMENT STRESS ANALYSIS OF A COMPRESSION MOLD Final Report
C. E. Watterson Mar. 1980 34 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2387) Avail: NTIS HC A03/MF A01

Thermally molding stresses occurring in a compression mold during production molding were evaluated using finite element analysis. A complementary experimental stress analysis, including strain gages and thermocouple arrays, verified the finite element model under typical loading conditions. DOE

N80-32802# Argonne National Lab., Ill. Materials Science Div.
BIAXIAL CREEP-FATIGUE BEHAVIOR OF MATERIALS FOR SOLAR THERMAL SYSTEMS
S. Majumdar May 1980 36 p refs
(Contract W-31-109-eng-38)
(ANL-80-34) Avail: NTIS HC A03/MF A01

Biaxial creep fatigue data for Incoloy 800 and Type 316H stainless steel at elevated temperatures are presented. Tubular specimens were subjected to constant internal pressure and strain controlled axial cycling with and without hold times in tension as well as in compression. The results show that the internal pressure affects diametral ratchetting and axial stress range significantly. However, the effect of a relatively small and steady hoop stress on the cyclicife of the materials is minimal. A 1 min compressive hold per cycle does not seriously reduce the fatigue life of either material; a tensile hole of equal duration causes a significant reduction in life for Type 316H stainless steel, but none for Incoloy 800. Fracture surfaces of specimens made of both materials were studied by scanning electron microscopy to determine the reason for the difference in behavior. DOE

N80-32803# Hanford Engineering Development Lab., Richland, Wash.
IN-REACTOR FATIGUE CRACK PROPAGATION
A. M. Ermi, D. A. Mervyn, and J. L. Straalsund Aug. 1979 15 p Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13-16 Nov. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1927; CONF-791102-158) Avail: NTIS HC A02/MF A01

An in-reactor fatigue experiment designed to determine the effect of dynamic irradiation on the fatigue crack propagation (FCP) behavior of candidate fusion first wall materials is described. The experiment utilizes miniature center-cracked-tension specimens developed specifically for in-reactor studies. In the test, a chain of eight specimens, precracked to various initial crack lengths, is stressed during irradiation to determine crack growth rate as a function of stress intensity. Load levels were chosen which result in small crack growth rates encompassing a regime of the crack growth curve not previously investigated during irradiation studies of FCP. Detailed design of the experiment is presented along with crack growth data obtained from prototypic testing of the experimental apparatus. These results are compared to data obtained under similar conditions generated by conventional test methods. DOE

42 GEOSCIENCES (GENERAL)

N80-32804# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.
EARTH'S ROTATION IN 1975-1979 BASED ON DOPPLER SATELLITE OBSERVATIONS Final Report
Richard J. Anderle May 1980 59 p refs
(AD-A088095; NSWC/TR-80-232) Avail: NTIS HC A04/MF A01 CSCL 03/3

Doppler observations of Navy Navigation Satellites have been used to determine changes in Earth's rotation during the years 1975-1979. Annual and semiannual variations determined from the Doppler observations are not valid due to the neglect of the gravitational effects of atmospheric and ocean tides on the orbit of a satellite. However, variations with periods of 50 to 120 days are correlated well with astronomic results. These variations integrate to amplitudes of two or more milliseconds in UT-1. Shorter period variations only occasionally correlate with astronomic results. There are also occasional conflicts in phases; and, generally, there is only about a 50 percent agreement in amplitude of the shorter period variations obtained from observations of different satellites. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

N80-32805*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
EVALUATION OF REMOTE SENSING TECHNIQUES ON SELECTED FOREST SITES IN FLORIDA Final Report
L. G. Arvanitis, R. Reich, and R. Newburne, Principal Investigators Feb. 1980 127 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS10-9466)
(E80-10296; NASA-CR-154635) Avail: NTIS HC A07/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-32806*# Remote Sensing Inst., Brookings, S. Dak.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND-WATER POLLUTION Interim Report, Apr. - Jun. 1980
Donald G. Moore, Principal Investigator and J. L. Heilman Jun. 1980 25 p refs HCMM
(Contract NAS5-24206)
(E80-10310; NASA-CR-163350; SDSU-RSI-80-07) Avail: NTIS HC A02/MF A01 CSCL 13B

The author has identified the following significant results. Significant relationships were found between surface soil temperatures estimated from HCMM radiometric temperatures and depth to ground water and near surface soil moisture.

N80-32807*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. 1: LANDSAT. 2: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Feb. - 31 Jul. 1980
Richard W. Birnie and Richard E. Stoiber, Principal Investigators 31 Jul. 1980 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NCC5-22)
(E80-10312; NASA-CR-163401; SASR-1) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32808*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A MULTIPROCESSOR IMPLEMENTATION OF A CONTEXTUAL IMAGE PROCESSING ALGORITHM
B. W. Smith, H. J. Siegel, and P. H. Swain, Principal Investigators Jul. 1980 234 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10313; NASA-CR-163402; LARS-070180; SR-P0-00474) Avail: NTIS HC A11/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32809*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AN ALGORITHM FOR ESTIMATING CROP CALENDAR SHIFTS OF SPRING SMALL GRAINS USING LANDSAT SPECTRAL DATA
Eric P. Crist and William A. Malila, Principal Investigators Jun. 1980 40 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10314; NASA-CR-160762; ERIM-132400-41-T; SR-EO-00459) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-32810*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
SEASAT-A LAND APPLICATIONS DATA PROCESSING PLAN
S. B. Chism, Jr., Principal Investigator Jan. 1977 50 p refs ERTS
(Contract NAS9-15200)
(E80-10317; NASA-CR-160640; JSC-12574; LEC-9978) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32811*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
HIGH DENSITY TAPE REFORMATTING SYSTEM/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDTRS/LIVES) PRODUCTION TEST THROUGHPUT ANALYSIS
A. J. Bowen, Jr., Principal Investigator Jun. 1980 39 p refs ERTS
(Contract NAS9-15800)
(E80-10319; NASA-CR-160735; JSC-16718; LEMSCO-15039) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32812*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR EQUIPROBABILITY ELLIPSES REPRESENTATION OF CLASSY CLUSTERS
C. L. Horton and R. K. Lennington, Principal Investigators Mar. 1980 52 p ref ERTS
(Contract NAS9-15800)
(E80-10320; NASA-CR-160740; JSC-16703; LEMSCO-15019) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32813*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
OPERATION PLAN FOR THE HIGH DENSITY TAPE/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDT/LIVES) DATA PROCESSING SUPPORT
A. J. Bowen, Jr., Principal Investigator Jun. 1980 28 p refs
(Contract NAS9-15800)
(E80-10322; NASA-CR-160736) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32814*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR CCIT8 PROCESSOR PROGRAM
R. F. Hansen, Principal Investigator Feb. 1979 65 p ERTS
(Contract NAS9-15800)
(E80-10323; NASA-CR-160738; LEC-13077; JSC-14704) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32815*# California Univ., Berkeley. Space Sciences Lab.
IRRIGATED LANDS ASSESSMENT FOR WATER MANAGEMENT APPLICATIONS PILOT TEST (APT) Final Report
Robert N. Colwell, John E. Estes, and Larry Tinney, Principal Investigators 31 Jan. 1980 156 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NsG-2207)
(E80-10324; NASA-CR-163404; SSL-Ser-21-Issue-5) Avail: NTIS HC A08/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-32816*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR A LIST PROCESSING SYSTEM
C. W. Ahlers, P. J. Aucoin, Jr., and C. L. Horton, Principal Investigators Jan. 1979 281 p refs ERTS
(Contract NAS9-15800)
(E80-10325; NASA-CR-160739; JSC-14663; LEC-13076) Avail: NTIS HC A13/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32817*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA Annual Report
Robert N. Colwell, Andrew S. Benson, John E. Estes, and Claude Johnson, Principal Investigators 1 May 1980 438 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-7220)
(E80-10326; NASA-CR-163405; SSL-Ser-21-Issue-14) Avail: NTIS HC A19/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-32818*# California Univ., Berkeley. Space Sciences Lab.
DEVELOPMENT OF AI PROCEDURES FOR DEALING WITH THE EFFECTS OF EPISODAL EVENTS ON CROP TEMPORAL SPECTRAL RESPONSE AND DEVELOPMENT OF AI GUIDELINES FOR CORN AND SOYBEAN LABELING Annual Progress Report, 15 Nov. 1978 - 14 Nov. 1979
Robert N. Colwell, Principal Investigator Nov. 1979 193 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS9-14565; Proj. AgRISTARS)
(E80-10327; NASA-CR-160733; SSL-Ser-20-Issue-44; SR-B9-00434) Avail: NTIS HC A09/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-32819*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USING LANDSAT DIGITAL DATA FOR ESTIMATING GREEN BIOMASS
D. W. Deering and Robert H. Haas, Principal Investigators (Texas A and M Univ., College Station) Jun. 1980 26 p refs Presented at the 30th Ann. Meeting of the Soc. for Range Management

Symp. on Rangeland Remote Sensing, Portland, Oreg., 17 Feb. 1977 Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10328; NASA-TM-80727) Avail: NTIS HC A03/MF A01 CSCL 06C

The author has identified the follwoing significant results. Relationships between the quantity of mixed prairie rangelenad vegetation and LANDSAT MSS response were studied during four growing seasons at test sites throughout the United States Great Plans region. A LANDSAT derived parameter, the normalized difference was developed from theoretical considerations fro statistical estimation of the amount and seasonal condition of rangeland vegetation. This parameter was tested for application to local assessment of green forage biomass and regional monitoring of range feed conditions and drought. Results show that for grasslands in the Great Plains with near continuous vegetative cover and free of heavy brush and forbs, the LANDSAT digital data can provide a useful estimate of the quantity of green forage biomass (within 250 kg/ha), and at least five levels of pasture and range feed conditions can be adequately mapped for extended regions.

N80-32820*# Lancaster Univ. (England). Lunar and Planetary Unit.
SATELLITE MONITORING OF SEA SURFACE POLLUTION Final Report, Jan. 1977 - Jul. 1980
Gilbert Fielder, Timothy Stuart Hall, Principal Investigators, Duncan John Telfer, Lionel Wilson, and Richard John Fryer Jul. 1980 20 p HCMM
(NASA Order RD-1182)
(E80-10329; NASA-CR-163415; Rept-2-15/DF1) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N80-32821*# Arizona Univ., Tucson. Office of Arid Lands Studies.
APPLIED REMOTE SENSING PROGRAM (ARSP) Annual Report, 1979 - 1980
Jack D. Johnson, Charles F. Hutchinson, David A. Mouat, Principal Investigators, Robert A. Schowengerdt, Linda S. Leigh, Michael C. Parton, Karen L. Reichardt, Charles H. Sauerwein, and Peter L Warren Jul. 1980 87 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-03-002-313)
(E80-10330; NASA-CR-163416) Avail: NTIS HC A05/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-32822*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED-TEMPERATURE VARIABILITY IN A LARGE AGRICULTURAL FIELD
John P. Millard, Robert C. Goettelman (LFE Corp., Richmond, Calif.), and Mary L. LeRoy, Principal Investigators Aug. 1980 26 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10331; NASA-TM-81222; A-8283) Avail: NTIS HC A03/MF A01 CSCL 02C

The combined effect of water carved gullies, varying soil color, moisture state of the soil and crop, nonuniform phenology, and bare spots was measured for commercially grown barley planted on varying terrain. For all but the most rugged terrain, over 80% of the area within 4, 16, 65, and 259 ha cells was at temperatures within 3 C of the mean cell temperature. The result of using relatively small, 4 ha instantaneous field of views for remote sensing applications is that either the worst or the best of conditions is often observed. There appears to be no great advantage in utilizing a small instantaneous field of view instead of a large one for remote sensing of crop canopy temperatures. The two alternatives for design purposes are then either a very high spatial resolution, of the order of a meter or so, where the field is very accurately temperature mapped, or a low resolution, where the actual size seems to make little difference.

N80-32823*# Joint Research Centre of the European Communities, Ispra (Italy).
HCMM SATELLITE FOLLOW-ON INVESTIGATION NO. 025: SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST (TELLUS PROJECT) Progress Report, 1 Sep. 1979 - 31 Mar. 1980
S. Galli deParatesi, Principal Investigator 31 Mar. 1980 63 p refs Sponsored by NASA HCMM
(Proj. TELLUS)
(E80-10332; NASA-CR-163539; PR-2) Avail: NTIS HC A04/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-32824*# Joint Research Centre of the European Communities, Ispra (Italy).
FURTHER DEVELOPMENTS OF THE TELL-US MODEL. 1: AN IMPLICIT FINITE DIFFERENCE SCHEME FOR THE NUMERICAL APPROXIMATION OF THE GROUND HEAT FLUX. 2: A SIMPLE ALGORITHM FOR ESTIMATING THE ACTUAL AND POTENTIAL EVAPOTRANSPIRATION OF VEGETATED SURFACES FROM ONE REMOTELY SENSED SURFACE TEMPERATURE NEAR THE DAILY MAXIMUM
J. Huygen, Principal Investigator Nov. 1979 19 p refs Sponsored by NASA HCMM
(Proj. TELLUS)
(E80-10333; NASA-CR-163540) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32825*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1979 - 31 Mar. 1980
B. G. Barr and E. A. Martinko, Principal Investigators Jul. 1980 108 p Original contains color imagery. Orginal photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-17-004-024)
(E80-10337; NASA-CR-163417) Avail: NTIS HC A06/MF A01 CSCL 13B

There are no author identified significant results in this report.

N80-32826*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1979
W. Frank Miller, Dale A. Quattrochi, Bradley D. Carter, Gary K. Higgs, and Jimmy L. Solomon, Principal Investigators 1 Nov. 1979 55 p Original contains color illustrations ERTS
(Grant NGL-25-001-054)
(E80-10338; NASA-CR-163418; SAPR-12) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-32827*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A METHODOLOGY FOR THE ENVIRONMENTAL ASSESSMENT OF ADVANCED COAL EXTRACTION SYSTEMS
Patrick J. Sullivan, Charles F. Hutchinson, Jeanne Makihara, and Jill Evensizer 15 Jun. 1980 204 p refs
(Contracts NAS7-100; ET-75-I-01-9036)
(NASA-CR-163570; JPL-Pub-79-82) Avail: NTIS HC A10/MF A01 CSCL 08I

Procedures developed to identify and assess potential environment impacts of advanced mining technology as it moves from a generic concept to a more systems definition are described. Two levels of assessment are defined in terms of the design stage of the technology being evaluated. The first level of analysis

is appropriate to a conceptual design. At this level it is assumed that each mining process has known and potential environmental impacts that are generic to each mining activity. By using this assumption, potential environmental impacts can be identified for new mining systems. When two or more systems have been assessed, they can be evaluated comparing potential environmental impacts. At the preliminary stage of design, a systems performance can be assessed again with more precision. At this level of systems definition, potential environmental impacts can be analyzed and their significane determined in a manner to facilitate comparisons between systems. At each level of analysis, suggestions calculated to help the designer mitigate potentially harmful impacts are provided. A.R.H.

N80-32829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STEREOSAT: A PROPOSED PRIVATE SECTOR/ GOVERNMENT JOINT VENTURE IN REMOTE SENSING FROM SPACE
Richard L. Anglin 1 Aug. 1980 130 p refs
(Contract NAS7-100)
(NASA-CR-163569; JPL-Pub-80-70) Avail: NTIS HC A07/MF A01 CSCL 22A

Stereosat, a free flying Sun synchronous satellite whose purpose is to obtain worldwide cloud-free stereoscopic images of the Earth's land masses, is proposed as a joint private sector/government venture. A number of potential organization models are identified. The legal, economic, and institutional issues which could impact the continuum of potential joint private sector/government institutional structures are examined. S.F.

N80-32829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT. VOLUME 2: FLIGHT SYSTEMS Final Report
E. Pounder, ed. 1 Sep. 1980 369 p refs
(Contract NAS7-100)
(NASA-CR-163571; JPL-Pub-80-38-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 05B

Flight systems used in the Seasat Project are described. Included are (1) launch operation; (2) satellite performance after launch; (3) sensors that collected data; and (4) the launch vehicle that placed the satellite into Earth orbit. Techniques for sensor management are explained. S.F.

N80-32830*# Martin Marietta Aerospace, Denver, Colo.
THE APPLICABILITY OF REMOTE SENSING TO EARTH BIOLOGICAL PROBLEMS. PART 2: THE POTENTIAL OF REMOTE SENSING IN PEST MANAGEMENT Final Report
J. T. Polhemus Aug. 1980 41 p refs 2 Vol.
(Contract NAS9-15918)
(NASA-CR-163589; MCR-80-610-pt-2; FR-2-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 06C

Five troublesome insect pest groups were chosen for study. These represent a broad spectrum of life cycles, ecological indicators, pest management strategies, and remote sensing requirements. Background data, and field study results for each of these subjects is discussed for each insect group. Specific groups studied include tsetse flies, locusts, western rangeland grasshoppers, range caterpillars, and mosquitoes. It is concluded that remote sensing methods are aplicable to the pest management of the insect groups studied. J.M.S.

N80-32831# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOCHEMISTRY OF SOME BRAZILIAN RIVERS
L. M. Moreira-Nordemann Jun. 1980 17 p refs Submitted for publication
(INPE-1797-RPE/167) Avail: NTIS HC A02/MF A01

Concentrations of the totality of the dissolved salts and of sodium, calcium, potassium, magnesium and uranium were measured in ten rivers belonging to three hydrographic basins located in northeastern Brazil. Activity ratios U234/U238 were also measured. A correlation between the results obtained and the geological and climatic context of these regions was computed. Sodium is the most abundant element in the waters, except for rivers flowing in calcareous regions for which calcium is predominant. The concentrations of the major cations seem to be a function of the regional lithology whereas water salinity depends on climatic factors. R.K.G.

N80-32832# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COLLECTION, PROCESSING, AND DISTRIBUTION OF REMOTE SENSING DATA FROM BRAZILIAN RECEIVING STATION
Iselson deJesusParada Jun. 1980 18 p
(INPE-1784-RPE/156) Avail: NTIS HC A02/MF A01

Basic information about the Brazilian LANDSAT tracking, receiving, processing and distribution system operated by INPE the Cachoeira Paulista Electronic and Photographic Processing Laboratory and Distribution Center. The increase of the users community - with more than 1,200 participant organizations - and the increase of the volume of images produced - near 20,000 in 1979 - are effective demonstration of the importance of remote sensing in Brazil. Types and prices of products available, product request and related items are discussed. Also, the already planned future achievements of the Brazilian Remote Sensing Satellite Program are briefly described. R.K.G.

N80-32833# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLANNING AND EXECUTION OF A PHOTOGRAPHIC MISSION OVER A WHEAT PRODUCING REGION IN RIO GRANDE DO SUL, BRAZIL
Paulo Cesar Gurgel deAlbuquerque and Dal Arthur Cottrell Jun. 1980 11 p
(INPE-1793-RPE/165) Avail: NTIS HC A02/MF A01

A wheat survay program was completed with the execution of a photographic mission during the booting growth stage of wheat. Three 20 km. by 40 km. target areas in Rio Grande do Sul were flown after cost/time saving changes in aircraft, oxygen requirements, geometric parameters and base of operations. A WILD RC-10 metric camera with WRATTEN filter was used to expose color IR film to produce 1:20,000 scale transparencies and semicontrolled mosaics for hectareage estimations and data integration with hardware for CCT analyses. R.K.G.

N80-32834# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
GEOCHEMICAL BALANCE OF THE SALGADO RIVER BASIN
L. M. Moreira-Nordemann and D. Nordemann Aug. 1980 43 p refs Submitted for publication
(INPE-1849-RPE/206) Avail: NTIS HC A03/MF A01

The Salgado River basin (Bahia State, Brazil) was studied from the point of view of present climatic and geochemical conditions: inappropriate exploitation, irregular rainfall and high evaporation rate resulting in a state of unbalanced geochemical conditions. The water of the Salgado River showed high concentration of the total dissolved salts. The mean chemical composition and weathering rate of the rocks of the river basin were measured. S.F.

N80-32835# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CHARACTERIZATION OF CERRADO VEGETATION USING AUTOMATICALLY CLASSIFIED LANDSAT MSS DATA
Joao Roberto Dos Santos, Vitor Celso DeCarvalho, and Hideyo Aoki (Sao Paulo Univ.) Jun. 1980 13 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980
(INPE-1790-RPE/162) Avail: NTIS HC A02/MF A01

The characterization of physiognomic unities of cerrado vegetation through automatic IMAGE 100 analysis of LANDSAT MSS data was studied. The separability of the unities analyzed was verified (cerrado, campo cerrado, campo sujo) from respective spectral signatures obtained using a MAXVER and a JM distances algorithm. A correlation analysis of correctly classified values was performed. The results obtained include the following: (1) the use of four channels together presented the best class separation, independent of season; (2) in considering the use of isolated channels, channel 5 provided the largest percent correct classification; and (3) the highest separability was observed between cerrado and campo sujo forms. It is concluded that the separability of physiognomic unities can contribute to studies for the rational use of cerrado areas. R.K.G.

N80-32836# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE USE OF LANDSAT DATA FOR EVALUATION AND CHARACTERIZATION OF DEFORESTED PASTURELAND AND REFORESTED AREAS IN BRAZIL
Pedro Hernandez Filho, Armando Pacheco Dossantos, Evlyn Marcia Leao DeMoraesNovo, Yosio Edemir Shimabukuro, Valdete Duarte, Jose Simeao deMedeiros, Eduardo Carlos Mignone Alves, and Carlito Chefer deSantana Jun. 1980 9 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Prepared in cooperation with Brazilian Inst. for Forest Development, Sao Jose dos Campos
(INPE-1794-RPE/166) Avail: NTIS HC A02/MF A01

The compatibility of using LANDSAT data for pastureland and reforestation studies was studied. The degradation of pastureland after deforestation was identified automatically using four indicators: the percentages of exposed soil, lateritic soil, types of juquira and Gramineae species. Pine and eucalypt plantations were identified manually and automatically. The classification accuracy is 94.31 percent for pine and ranges from 67.23 to 92.30 percent for eucalypt. S.F.

N80-32837# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING APPLIED TO THE PROSPECTING OF GEOTHERMAL ANOMALY IN CALDAS NOVAS COUNTY, STATE OF GOIAS, BRAZIL
Paulo Venezioni and Celio Eustaquio DosAnjos Jun. 1980 6 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980
(INPE-1792-RPE/164) Avail: NTIS HC A02/MF A01

Thermally anomalous areas associated with hot waters in the County of Caldas Novas, State of Goias, Brazil were studied. Data collection using a 50 cm soil thermometer and a Precision Radiation Thermometer indicated the presence of four principal anomalies. These areas were verified in the field. In the area of the town of Caldas Novas, of 14 deep wells drilled, none revealed water temperatures from 33 to 41 C, two contained hot mud, and one contained sulfurous water measured at 29 C. Two day wells were also encountered. L.F.M.

N80-32838*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON EXTRACTING BRIGHTNESS TEMPERATURE MAPS FROM SCANNING RADIOMETER DATA
P. Argentiero and Raul Garza-Robles Aug. 1980 27 p refs Submitted for publication
(NASA-TM-81989) Avail: NTIS HC A03/MF A01 CSCL 08B

The extraction of brightness temperature maps from scanning radiometer data is described as a typical linear inverse problem. Spatial quantization and parameter estimation is described and is suggested as an advantageous approach to a solution. Since this approach takes into explicit account the multivariate nature of the problem, it permits an accurate determination of the most detailed resolution extractable from the data as well as explicitly defining the possible compromises between accuracy and resolution. To illustrate the usefulness of the method described for algorithm design and accuracy prediction, it was applied to the problem of providing brightness temperature maps during the NOSS flight segment. The most detained possible resolution was determined and a curve which displays the possible compromises between accuracy and resolution was provided.
Author

N80-32839# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
HORIZONTAL DATUMS FOR NAUTICAL CHARTS
Thomas J. Vogel Jul. 1980 23 p
(AD-A088340) Avail: NTIS HC A02/MF A01 CSCL 08/5

Marine navigation charts are based on many and varied geodetic datums in use throughout the world. These datums range from local datums to the DoD World Geodetic System (WGS) 1972. In many cases, the datums for adjoining charts will differ, although this difference will usually introduce only minor errors into the solution of navigational problems. There are times, however, when even small errors can be very disconcerting, if not dangerous, and it is under these conditions that it is advantageous for the navigator to possess some knowledge of the factors in datum selection and chart construction which lead to apparent discrepancies in position plotting. It is equally important for the chart compiler or cartographer to understand the basic principles of navigation and, therefore, the need for establishing clearly definable horizontal datums on charts. For this reason, the author has aimed at tracing the evolution of datums on Defense Mapping Agency (DMA) nautical charts, mainly for the benefit of cartographers who must realize how the product they produce impacts on the safety of navigation in ways other than the portrayal of up to date information such as navigation aids, depths, etc. This paper discusses the differences between chart datums and coordinates determined by using various navigation systems, accuracy requirements for nautical charts, navigation system accuracy requirements as related to datums, and datum transformation methods. GRA

N80-32840# Earth Satellite Corp., Washington, D. C.
GEOMETRIC PATTERN RECOGNITION TECHNIQUES APPLIED TO LAND LANDSAT DIGITAL DATA FOR URANIUM EXPLORATION
1979 291 p refs
(Contract DE-AC13-76GJ-01664)
(GJBX-26(80)) Avail: NTIS HC A13/MF A01

Six training sites were selected, consisting of Copper Mountain (Wyoming), Pumkin Buttes/Kaycee (Wyoming), Grants (New Mexico), Rossing (Namibia), Marysvale (Utah), and Beaverlodge (Saskatchewan). For each of these sites, displays and/or texture measures were generated, and where possible discrimination functions were developed to separate known uraniferous areas from areas of unknown uranium content. Of all data sources and all texture measures, the most successful was the measure pair, inverse difference moment plotted against angular second moment, applied to the third eigenband of the LANDSAT data. This measures pair permitted separation of uranium from non-uranium in certain geologies (particularly Pumpkin Buttes/ Kaycee) but was unsuccessful in others. Although the results obtained cannot be described as providing a new tool for uranium exploration, there is clear evidence that computed texture measures are describing some element of the LANDSAT data source that cannot be readily observed or analyzed by human interpreters. DOE

N80-32841# Arctec, Inc., Columbia, Md.
SAINT LAWRENCE RIVER ALL-YEAR NAVIGATION ICE CONTROL SYSTEM Final Report
Jack W. Lewis and Robert P. Johnson Apr. 1980 145 p refs Sponsored in part by Winter Navigation Season Extension Demonstration Program
(Contract DOT-SL-76-469)
(PB80-183478; SLSDC-281C-3) Avail: NTIS HC A07/MF A01 CSCL 08L

Designs and specifications for an ice control system which would allow all year navigation in the Brockville to Cardinal section of the international portion of the are proposed. A distorted scale (horizontal scale, 1:150; vertical scale, 1:60) hydraulic model of the section of the river extending from Stillwells Point, New York to Red Mills, New York was utilized. Three alternative ice control systems were tested under varying river flow rates and stage and under varying ice conditions which included ice cover formation, consolidated ice covers, and spring breakup. GRA

N80-32842# Ohio State Univ., Columbus. Water Resources Center.
PRELIMINARY ESTIMATE OF REGIONAL EFFECTIVE GROUND-WATER RECHARGE RATES, RELATED STREAM FLOW AND WATER QUALITY IN OHIO Completion Report
Wayne A. Pettyjohn and Roger J. Henning 1979 333 p refs
(PB80-193535; W80-05466; OWRT-A-051-OHIO-1) Avail: NTIS HC A15/MF A01 CSCL 08H

Regional effective ground water recharge rates during years of low, normal and high precipitation were calculated for Ohio by means of stream hydrograph separations using a computer. The included programs also produce tables of monthly and annual recharge rates, separated stream hydrographs, flow duration curves and tables, quality duration curves and tables, as well as quality

ratio graphs. Computer output is compared with manual separation techniques. GRA

N80-32843# Nebraska Univ., Lincoln. Dept. of Industrial and Management Systems Engineering.
MAPPING MODEL FOR DETERMINING LAND SUITABLE FOR IRRIGATION Final Report
Richard O. Hoffman 28 Apr. 1980 25 p refs
(Contract DI-14-31-0001-5027)
(PB80-188683; W80-05246; OWRT-A-039-NEB-1) Avail: NTIS HC A02/MF A01 CSCL 08B

CMS-11, a computer composite mapping system, was adapted for use on the IBM 360, Model 198 computer system at the University of Nebraska for use in developing a Nebraska map showing land that is suitable for the development of irrigation systems. A land use mapping process was used based on viewing each piece of land on two separate color IR aerial photos, one taken in early summer and the other in late summer. Separate computer plots were produced for each of 27 types of land use. The program was also used to develop a mathematical model that predicts the number of acres that will be developed in future years for each soil series. GRA

N80-32844# Bureau of Mines, Denver, Colo. Denver Research Center.
DEVELOPMENT OF A METHOD TO DETECT GEOLOGIC FAULTS AND OTHER LINEAR FEATURES FROM LANDSAT IMAGES Report of Investigations, 1980
Richard G. Burdick and Robert A. Speirer 1980 81 p refs
(PB80-189665; BM-RI-8413) Avail: NTIS HC A05/MF A01 CSCL 08G

A detection method for use with a minicomputer was developed. The method comprises a suite of programs that scans an image for all 'potential' lineaments. From this partially analyzed data, the final lineaments are picked by another routine. The method was field tested and results indicated good agreement between computer picked lineaments and ground features. GRA

N80-32845# Columbia Univ., New York. Aldridge Lab. of Applied Geophysics.
DETECTION OF HIDDEN MINERAL DEPOSITS BY AIRBORNE SPECTRAL ANALYSIS OF FOREST CANOPIES
William Collins, Sheng-Huei Chang, and John T. Kuo 1979 66 p refs
(Grant NSF DAR-78-16320)
(PB80-193881; NSF/RA-800041) Avail: NTIS HC A04/MF A01 CSCL 08G

Field surveys and data analysis of four biogeochemical test sites confirmed the ability of an airborne system with high spectral resolution to detect an anomalous spectral waveform that appeared to be associated with sulfide mineralization. Known or suspected sulfide zones were detected on each site. GRA

N80-32846# Robertson Research (US), Inc., Houston, Tex.
PALEONTOLOGICAL RESOURCES EVALUATION: WEST DIVIDE PROJECT Final Report
Robert E. Sloan, Joseph H. Hartman, Laurie J. Dempsey, Martha E. Jordan, and Eddie B. Robertson Mar. 1980 61 p refs
(Contract DI-9-07-40-S0811)
(PB80-189889) Avail: NTIS HC A04/MF A01 CSCL 08G

A survey of the literature on the paleontological resources of the rock formation in the West Divided Project area is presented. The presence of several fossil rich sites in or near the proposed construction zone were revealed. The field investigation concentrated on these sites with the object of assessing the impact of the project on them. GRA

N80-32847# Robertson Research (US), Inc., Houston, Tex.
PALEONTOLOGICAL RESOURCES EVALUATION: RED FLEET RESERVOIR Final Report
Robert E. Sloan, Joseph H. Hartman, Laurie J. Dempsey, Martha E. Jordan, and Eddie B. Robertson Mar. 1980 54 p refs
(Contract DI-9-07-40-S0811)
(PB80-204258) Avail: NTIS HC A04/MF A01 CSCL 08G

The literature on the paleontological resources of the rock formations in the Red Fleet Reservoir area revealed that no previous collections were made within the reservoir take line. Significant collections of Jurassic vertebrates were documented from nearby areas such as Dinosaur National Monument. Field investigations uncovered fossil material from several rock formations and localities near and within the reservoir. The fossil material identified, which includes invertebrates from several horizons and disarticulated dinosaur bone material from the Morrison Formation, does not appear to be of significant scientific value. No mitigation measures are recommended. GRA

N80-32848# Geological Survey, Madison, Wis.
COMPARISON OF TRACER METHODS AND PREDICTIVE EQUATIONS FOR DETERMINATION OF STREAM-REAERATION COEFFICIENTS ON THREE SMALL STREAMS IN WISCONSIN Final Report
R. S. Grant and Steven Skavroneck (Wisconsin Dept. of Natural Resources, Madison) Apr. 1980 43 p refs
(PB80-193642; USGS/WRD/WRI-80/024; USGS/WRI-80-19)
Avail: NTIS HC A03/MF A01 CSCL 08H

Four modified nonradioactive tracer methods and 20 predictive equations for determination of stream reaeration coefficients (K2) in three small Wisconsin streams were compared with the radioactive tracer method developed by Tsivoglou. Of the four modified tracer techniques, the propane area technique, which measures the total weight of propane gas passing stream sampling stations, yielded the least mean absolute difference of 11.0 percent compared with the radioactive tracer method. The propane peak concentration, ethylene peak concentration, and ethylene total weight methods gave mean absolute differences of 18, 21, and 26 percent, respectively. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-32849* National Aeronautics and Space Administration, Washington, D. C.
ENERGY, A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 26, 1 APRIL - 30 JUNE 1980
Jul. 1980 321 p
(NASA-SP-7043(26)) Avail: NTIS HC $15.00 CSCL 10B

This bibliography lists 1134 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System from April 1, 1980 through June 30, 1980. Author

N80-32850*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVING THE EFFICIENCY OF SILICON SOLAR CELLS CONTAINING CHROMIUM Patent Application
Amal M. Salama, inventor (to NASA) (JPL) Filed 11 Sep. 1980 16 p
(Contract NAS7-100)
(NASA-Case-NPO-15179-1; US-Patent-Appl-SN-185867) Avail: NTIS HC A02/MF A01 CSCL 10A

Efficiency of silicon solar cells containing about 10 to the 15th power atoms/cu cm of chromium is improved about 26% by thermal annealing of the silicon wafer at a temperature of 200 C to form chromium precipitates having a diameter of less than 1 Angstrom. Further improvement in efficiency is achieved by scribing laser lines onto the back surface of the wafer at a spacing of at least 0.5 mm and at a depth of less than 13 micrometers to preferentially precipitate chromium near the back surface and away from the junction region of the device. This provides an economical way to improve the deleterious effects of chromium, one of the impurities present in metallurgical grade silicon material. NASA

N80-32851*# ARATEX Services, Inc., Encino, Calif.
SOLAR HOT WATER DEMONSTRATION PROJECT AT RED STAR INDUSTRIAL LAUNDRY, FRESNO, CALIFORNIA Final Report
Jul. 1980 82 p Sponsored in part by NASA. Marshall Space Flight Center
(Contract EX-76-C-01-2384)
(NASA-CR-161537) Avail: NTIS HC A05/MF A01 CSCL 10A

The performance of a Solar Hot Water System at a laundry in Fresno, California is described. The system features an integrated wastewater heat recovery subsystem and a solar preheating system designed to supply a part of the hot water requirements. Performance data for a six month period are projected to an annual savings of $18,703. L.F.M.

N80-32852*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY PROJECT AND PROCEEDINGS OF THE 15TH PROJECT INTEGRATION MEETING Progress Report, Dec. 1979 - Apr. 1980
Apr. 1980 385 p Meeting held on 2-3 Apr. 1980
(Contracts NAS7-100; EX-76-A-29-1012)
(NASA-CR-163568; DOE/JPL-1012-44; JPL-Pub-80-27; PR-15) Avail: NTIS HC A17/MF A01 CSCL 10A

Progress made by the Low-Cost Solar Array Project during the period December 1979 to April 1980 is described. Project analysis and integration, technology development in silicon material, large area silicon sheet and encapsulation, production process and equipment development, engineering, and operation are included. R.K.G.

N80-32853*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
A COMPUTER MODEL OF SOLAR PANEL-PLASMA INTERACTIONS Final Report
David L. Cooke and John W. Freeman [1980] 59 p refs
(Contract NAS9-15796)
(NASA-CR-160796) Avail: NTIS HC A04/MF A01 CSCL 10A

High power solar arrays for satellite power systems are presently being planned with dimensions of kilometers, and with tens of kilovolts distributed over their surface. Such systems face many plasma interaction problems, such as power leakage to the plasma, particle focusing, and anomalous arcing. These effects cannot be adequately modeled without detailed knowledge of the plasma sheath structure and space charge effects. Laboratory studies of 1 by 10 meter solar array in a simulated low Earth orbit plasma are discussed. The plasma screening process is discussed, program theory is outlined, and a series of calibration models is presented. These models are designed to demonstrate that PANEL is capable of accurate self consistant space charge calculations. Such models include PANEL predictions for the Child-Langmuir diode problem. S.F.

N80-32854*# EIC, Inc., Newton, Mass.
HYDROGEN PRODUCTION BY PHOTOELECTROLYTIC DECOMPOSITION OF H2O USING SOLAR ENERGY Final Report, 1 Dec. 1975 - 30 Nov. 1979
R. D. Rauh, S. A. Alkaitis, J. M. Buzby, and R. Schiff Aug. 1980 66 p refs
(Contracts NAS7-100; JPL-955271)
(NASA-CR-163586; JPL-9950-406) Avail: NTIS HC A04/MF A01 CSCL 10A

Photoelectrochemical systems for the efficient decomposition of water are discussed. Semiconducting d band oxides which would yield the combination of stability, low electron affinity, and moderate band gap essential for an efficient photoanode are sought. The materials PdO and Fe-xRhxO3 appear most likely. Oxygen evolution yields may also be improved by mediation of high energy oxidizing agents, such as CO3(-). Examination of several p type semiconductors as photocathodes revealed remarkable stability for p-GaAs, and also indicated p-CdTe as a stable H2 photoelectrode. Several potentially economical schemes for photoelectrochemical decomposition of water were examined, including photoelectrochemical diodes and two stage, four photon processes. S.F.

N80-32855*# Burt, Hill, Kosar, Rittleman, and Associates, Butler, Pa. Research and Solar Applications Div.
OPERATION AND MAINTENANCE COST DATA FOR RESIDENTIAL PHOTOVOLTAIC MODULES/PANELS Final Report
J. R. Oster, Jr., D. R. Zaremski, Jr., E. M. Albert, and S. L. Hawkins Jul. 1980 106 p refs
(Contract JPL-955614)
(NASA-CR-163585; DOE/JPL-955614-80/1; JPL-9950-408) Avail: NTIS HC A06/MF A01 CSCL 10A

Costs associated with the operation and maintenance of residential photovoltaic modules and arrays are studied. Six basic topics related to operation and maintenance to photovoltaic arrays are investigated: maintenance; cleaning; panel replacement; gasket repair/replacement; wiring repair/replacement; and termination repair/replacement. The effects of the mounting types (rack mount, stand off mount, direct mount and integral mount) and the installation/replacement type (sequential, partial interruption and independent) are identified and described. Methods of reducing maintenance costs are suggested. S.F.

N80-32856*# Texas Univ., Austin. Center for Electromechanics.
A STUDY OF THE APPLICABILITY/COMPATIBILITY OF INERTIAL ENERGY STORAGE SYSTEMS TO FUTURE SPACE MISSIONS Final Report
William F. Weldon Aug. 1980 139 p refs Sponsored in part by Texas Atomic Energy Research Foundation
(Contracts NAS7-100; JPL-955679)
(NASA-CR-163584; JPL-9950-413) Avail: NTIS HC A07/MF A01 CSCL 10C

The applicability/compatibility of inertial energy storage systems like the homopolar generator (HPG) and the compensated pulsed alternator (CPA) to future space missions is explored. Areas of CPA and HPG design requiring development for space applications are identified. The manner in which acceptance parameters of the CPA and HPG scale with operating parameters of the machines are explored and the types of electrical loads which are compatible with the CPA and HPG are examined. Potential applications including the magnetoplasmadynamic (MPD) thruster, pulsed data transmission, laser ranging, welding and electromagnetic space launch are discussed. S.F.

N80-32857*# Rockwell International Science Center, Thousand Oaks, Calif.
STUDY PROGRAM FOR ENCAPSULATION MATERIALS INTERFACE FOR LOW COST SILICON SOLAR ARRAY Annual Report, 1 Jan. - 31 Dec. 1979
D. H. Kaelble, F. B. Mansfeld, J. B. Lunsden, III, and C. Leung Mar. 1980 88 p refs
(Contracts JPL-954739; N00014-75-C-0788; NR Proj. 036-108)
(NASA-CR-163583; DOE/JPL-954739-3; SC5106.86AR; JPL-9950-416; AR-1) Avail: NTIS HC A05/MF A01 CSCL 10A

An atmospheric corrosion model was developed and verified by five months of corrosion rate and climatology data acquired at the Mead, Nebraska LSA test site. Atmospheric corrosion rate monitors (ACM) show that moisture condensation probability and ionic conduction at the corroding surface or interface are controlling factors in corrosion rate. Protection of the corroding surface by encapsulant was shown by the ACM recordings to be maintained, independent of climatology, over the five months outdoor exposure period. The macroscopic corrosion processes which occur at Mead are shown to be reproduced in the climatology simulator. Controlled experiments with identical moisture and temperature aging cycles show that UV radiation causes corrosion while UV shielding inhibits LSA corrosion. R.K.G.

N80-32858*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINES: A UTILITY OPTION FOR THE GENERATION OF ELECTRICITY
W. H. Robbins, R. L. Thomas, and D. H. Baldwin 1980 18 p refs Presented at the Am. Power Conf., Chicago, 21-23 Apr. 1980; sponsored by Illinois Inst. of Tech.; presented at the Ann. Solar Energy Program Rev., Rockport, Maine, 26-28 Aug. 1980;

sponsored by Electric Power Research Inst.
(Contract DE-AI01-79ET-23139)
(NASA-TM-81502; DOE/NASA/23139-1; E-440) Avail: NTIS HC A02/MF A01 CSCL 10B

The wind resource is such that wind energy generation has the potential to save 6-7 quads of energy nationally. Thus, the Federal Government is sponsoring and encouraging the development of cost effective and reliable wind turbines. One element of the Federal Wind Energy Programs, Large Horizontal Axis Wind Turbine Development, is managed by the NASA Lewis Research Center for the Department of Energy. There are several ongoing wind system development projects oriented primarily toward utility application within this program element. In addition, a comprehensive technology program supporting the wind turbine development projects is being conducted. An overview is presented of the NASA activities with emphasis on application of large wind turbines for generation of electricity by utility systems. Author

N80-32858*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 6: IN-DEPTH ELEMENT INVESTIGATION Final Contractor Report
G. M. Hanley Sep. 1980 97 p refs
(Contract NAS8-32475)
(NASA-CR-3323; SSD-79-0010-6) Avail: NTIS HC A05/MF A01 CSCL 10A

The fabrication parameters of GaAs MESFET solid-state amplifiers considering a power added conversion efficiency of at least 80% and power gains of at least 10dB were determined. Operating frequency was 2.45 GHz although 914 MHz was also considered. Basic circuit to be considered was either Class C or Class E amplification. Two modeling programs were utilized. The results of several computer calculations considering differing loads, temperatures, and efficiencies are presented. Parametric data in both tabular and plotted form are presented. T.M.

N80-32860*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEM (SPS) CONCEPT DEFINITION STUDY. VOLUME 3: EXPERIMENTAL VERIFICATION DEFINITION Final Contractor Report
G. M. Hanley Sep. 1980 145 p
(Contract NAS8-32475)
(NASA-CR-3320; SSD-79-0010-3) Avail: NTIS HC A07/MF A01 CSCL 10A

An evolutionary Satellite Power Systems development plan was prepared. Planning analysis was directed toward the evolution of a scenario that met the stated objectives, was technically possible and economically attractive, and took into account constraining considerations, such as requirements for very large scale end-to-end demonstration in a compressed time frame, the relative cost/technical merits of ground testing versus space testing, and the need for large mass flow capability to low Earth orbit and geosynchronous orbit at reasonable cost per pound. T.M.

N80-32861*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 5: SPECIAL EMPHASIS STUDIES Final Report
G. M. Hanley Sep. 1980 265 p refs
(Contract NAS8-32475)
(NASA-CR-3322; SSD-79-0010-5) Avail: NTIS HC A12/MF A01 CSCL 10A

Satellite configurations based on the Satellite Power System baseline requirements were analyzed and a preferred concept selected. A satellite construction base was defined, precursor operations incident to establishment of orbital support facilities identified, and the satellite construction sequence and procedures developed. Rectenna construction requirement were also addressed. Mass flow to orbit requirements were revised and traffic models established based on construction of 60 instead of 120 satellites. Analyses were conducted to determine satellite control, resources, manufacturing, and propellant requirements. The impact of the laser beam used for space-to-Earth power transmission upon the intervening atmosphere was examined as well as the inverse effect. The significant space environments and their effects on spacecraft components were investigated to define the design and operational limits imposed by the environments on an orbit transfer vehicle. The results show that LEO altitude <300 nmi and transfer orbit duration <6 months are preferrable. J.M.S.

N80-32862# Naval Research Lab., Washington, D. C.
ENERGY STORAGE AS HEAT-OF-FUSION IN CONTAINERIZED SALTS. REPORT ON ENERGY STORAGE BOILER TANK Interim Report
T. A. Chubb, J. J. Nemecek, and D. E. Simmons 27 Jun. 1980 110 p refs
(Contract EC-77-A-31-1024; RR0240145)
(AD-A087753; AD-E000495; NRL-MR-4267) Avail: NTIS HC A06/MF A01 CSCL 10/3

This report is concerned with energy storage based on heat-of-fusion in containerized salt. The 'energy storage boiler tank' uses evaporation and condensation of a heat transfer fluid to provide heat transfer into and out of stacked cans of salt. The 'energy storage superheater tank' uses a network of alkali metal heat pipes to distribute heat throughout a building filled with salt cans. It uses a radiation to transfer energy to and from stacked cans of salt. The paper summarizes the rationale for energy storage in containerized salt, it discusses salt availability, salt processing, container requirements, can technology and heat transfer fluid degradation problems. These discussions lead to estimates of energy storage system costs. The Naval Research Laboratory is building a 2 MWht proof-of-concept energy storage boiler tank. Laboratory investigations studying the compatibility of the heat transfer fluid with the molten storage salt are described, along with measurements of temperature drops associated with the energy input process. An assessment of the current status of the energy storage boiler tank is presented. GRA

N80-32863# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
USE OF SOLAR ENERGY TO PRODUCE PROCESS HEAT FOR INDUSTRY
Ken Brown Apr. 1980 28 p refs Presented at the 30th Ann. Plant Eng. and Maintenance Conf., Chicago, 24 Mar. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-731-626; CONF-800373-1) Avail: NTIS HC A03/MF A01

The role of solar energy in supplying heat and hot water to residential and commerical buildings is familiar. On the other hand, the role that solar energy may play in displacing imported energy supplies in the industrial and utility sectors often goes unrecognized. The versatility of solar technology lends itself well to applications in industry; particulary to the supplemental supply for process heat. The status of solar thermal technology for industrial process heat applications, including a description of current costs and operating histories is surveyed. The most important objectives to be met in improving system performance, reducing cost, and identifying markets for solar industrial process heat are outlined. DOE

N80-32864# Avco-Everett Research Lab., Mass.
OPEN-CYCLE MHD POWER CONDITIONING AND CONTROL REQUIREMENTS DEFINITION Final Report
S. Petty and K. Williams Mar. 1980 70 p refs
(EPRI-AP-1345) Avail: NTIS HC A04/MF A01

A generic inverter configuration is defined, and the relevant characteristics of line and forced commutated inverters are compared and evaluated for their suitability for magnetohydrodynamic (MHD) power application. The interface requirements of an MHD channel inverter utility interactive system are defined, and a forced commutated inverter meeting these requirements is described. The results of a set of tests using this inverter are described along with recommendations for future work in this field. DOE

N80-32865# SRI International Corp., Menlo Park, Calif.
DIRECT ELECTROCHEMICAL GENERATION OF ELECTRICITY FROM COAL Progress Report, 16 May 1977 - 15 Feb. 1979
Robert D. Weaver, Steven C. Leach, Arthur E. Bayce, and Leonard Nanis 1979 151 p refs

(Contract EY-76-C-03-0115)
(SAN-0115/105-1) Avail: NTIS HC A08/MF A01

The feasibility of the coal air fuel cell was investigated. Results of fabrication of anodes from coal, the factors influencing cell design and voltage current behavior of the carbon anode, and results of materials selection for the air cathode are among the topics discussed. The overall thermal efficiency of a nonoptimized plant is calculated and presented. The results indicate a nonpolluting process equivalent to or exceeding present day thermal efficiencies. Conservative analysis for a plant with carbon pellet anode feed and bottoming rhermal recovery indicates an overall efficiency of 53.3% and a cost of $758 per kilowatt (638 MW plant, 1978 dollars). This cost is below competing molten carbonate systems using gaseous anode feed. DOE

N80-32866# Braun (C. F.) and Co., Alhambra, Calif.
ASSESSMENT OF SULFUR REMOVAL PROCESSES FOR ADVANCED FUEL CELL SYSTEMS Final Report
G. A. Lorton Jan. 1980 156 p refs Sponsored by Electric Power Research Inst.
(EPRI-EM-1333) Avail: NTIS HC A08/MF A01

The performance characteristics of potential sulfur removal processes were evaluated and four of these processes, the Selexol process, the Benfield process, the Sulfinol process, and the Rectisol process, were selected for detailed technical and economic comparison. The process designs were based on a consistent set of technical criteria for a grass roots facility with a capacity of 10,000 tons per day of Illinois No. 6 coal. Two raw gas compositions, based on oxygen blown and air blown Texaco gasification, were used. The bulk of the sulfur was removed in the sulfur removal unit, leaving a small amount of sulfur compounds in the gas. The remaining sulfur compounds were removed by reaction with zinc oxide in the sulfur polishing unit. The impact of COS hydrolysis pretreatment on sulfur removal was evaluated. Comprehensive capital and O and M cost estimates for each of the process schemes were developed. DOE

N80-32867# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report
Nov. 1979 111 p refs
(Contracts ET-78-C-03-2051; DE-AC03-78ET-21050)
(DOE-ET-21050/1-1) Avail: NTIS HC A06/MF A01

The major effort of the project was development and assessment of a commercial scale power plant concept where both solar energy and fossil fuel are used to generate electricity. This so called hybrid concept was developed around a combined cycle gas turbine/steam turbine power plant. A market analysis, and parametric and system studies were included leading to a comparative evaluation of the Modified Strawman and Advanced Strawman systems. DOE

N80-32868# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY, VOLUME 2 Final Technical Report
Nov. 1979 491 p refs
(Contracts ET-78-C-03-2051; DE-AC03-78ET-21050)
(DOE-ET-21050-1-2) Avail: NTIS HC A21/MF A01

The conceptual design for a commercial scale (nominal 100 MWe) central receiver solar/fossil fuel hybrid power system with combined cycle energy conversion was developed. A near term, metallic heat pipe receiver and an advanced ceramic tube receiver hybrid system are defined through parametric and market potential analyses. Energy storage is not required and analyses show no economic advantages with energy storage provisions. It is concluded that the near term solar hybrid system is a cost effective alternative to conventional gas turbines and combined cycle generating plants, and has potential for intermediate load market penetration at 15% annual fuel escalation rate. Due to their flexibility, simple solar/nonsolar interfacing, and short startup cycles, these hybrid plants have significant operating advantages. Utility company comments suggest that hybrid power systems will precede stand-alone solar plants. DOE

N80-32869# Kilkeary, Scott and Associates, Inc., Arlington, Va.
DOCUMENTATION OF VOLUME 3 OF THE 1978 ENERGY INFORMATION ADMINISTRATION ANNUAL REPORT TO CONGRESS Annual Report
29 Feb. 1980 325 p refs
(Contract DE-AC01-79EI-10456)
(DOE/EIA-CR-0456) Avail: NTIS HC A14/MF A01

In a preliminary overview of the projection process, the relationship between energy prices, supply, and demand is addressed. Topics treated in detail include a description of energy economic interactions, assumptions regarding world oil prices, and energy modeling in the long term beyond 1995. Subsequent sections present the general approach and methodology underlying the forecasts, and define and describe the alternative projection series and their associated assumptions. Short term forecasting, midterm forecasting, long term forecasting of petroleum, coal, and gas supplies are included. The role of nuclear power as an energy source is also discussed. DOE

N80-32870# BDM Corp., McLean, Va.
PHOTOVOLTAIC APPLICATIONS DEFINITION AND PHOTOVOLTAIC SYSTEM DEFINITION STUDY IN THE AGRICULTURAL SECTOR. VOLUME 2: TECHNICAL RESULTS
R. W. Mengel, T. P. Nadolski, D. C. Sparks, S. K. Young, and A. Yingst May 1980 230 p Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-79-7018/2-Vol-2) Avail: NTIS HC A11/MF A01

This volume describes the technical results of the study of potential photovoltaic (P/V) applications in US agriculture. The results presented address all technical aspects of the program and include a summary of agricultural energy consumption. The objectives of the technical effort reported were to: (1) identify and characterize agricultural energy demands that can effectively use P/V power systems; (2) develop effective P/V system designs for the four most promising applications; (3) determine performance and cost estimates for the designs; and (4) recommend systems for early test and demonstration and critical issues requiring further systems studies. The farms chosen for conceptual design include: (1) poultry layer farm, (2) hog production farm, (3) beef feedlot, and (4) year round vegetable farm. DOE

N80-32871# Oak Ridge National Lab., Tenn. Energy Div.
COMPARISON OF SOLAR-THERMAL AND FOSSIL TOTAL-ENERGY SYSTEMS FOR SELECTED INDUSTRIAL APPLICATIONS
Gerald D. Pine Jun. 1980 75 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7022) Avail: NTIS HC A04/MF A01

Economic analyses of a conventional system and total energy systems based on phosphoric acid fuel cells, diesel piston engines, and central receiver solar thermal systems were performed for each of four industrial applications: a concrete block plant in Arizona, a fluid milk processing plant in California, a sugar beet processing plant in Colorado, and a meat packing plant in Texas. A series of sensitivity analyses was performed to show the effects of variations in fuel price, system size, cost of capital, and system initial cost. Solar total energy systems (STES) are more capital intensive than the other systems, and significant economies of scale are associated with the STES. If DOE solar system cost goals are met, STES can compete with the other systems for facilities with electrical demands greater than two or three megawatts, but STES are not competitive for smaller facilities. Significant energy resource savings, especially of oil and gas, resulted from STES implementation in the four industries. DOE

N80-32872# Sandia Labs., Albuquerque, N. Mex.
USER'S MANUAL FOR THE VERTICAL AXIS WIND TURBINE PERFORMANCE COMPUTER CODE DARTER
Paul C. Klimas and Ralph E. French May 1980 48 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1155) Avail: NTIS HC A03/MF A01

The computer code DARTER (DARrieus, Turbine, Elemental Reynolds number) is an aerodynamic performance/loads prediction scheme based upon the conservation of momentum principle. It is the latest evolution in a sequence which began with a model developed by Templin of NRC, Canada and progressed through the Sandia National Laboratories developed SIMOSS (Simple

MOmentum, Single Streamtube) and DART (Darrieus Turbine) to DARTER. DOE

N80-32873# Battelle Pacific Northwest Labs., Richland, Wash.
POROUS MEDIA EXPERIENCE APPLICABLE TO FIELD EVALUATION FOR COMPRESSED AIR ENERGY STORAGE
R. D. Allen and P. J. Gutknecht Jun. 1980 98 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3294) Avail: NTIS HC A05/MF A01

A survey is presented of porous media field experience that may aid in the development of a compressed air energy storage field demonstration. Related experience embraces technologies of natural gas, thermal energy, and geothermal and hydrogen storage. Natural gas storage technology lends the most toward compressed air storage development, keeping in mind the respective differences between stored fluids, physical conditions, and cycling frequencies. Both fluids are injected under pressure into an aquifer to form a storage bubble confined between a suitable caprock structure and partially displaced ground water. State-of-the-art information is summarized as the necessary foundation material for field planning. Suggested ranges are given for injection air temperature and reservoir pressure. DOE

N80-32874# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESIDENTIAL PHOTOVOLTAIC FLYWHEEL STORAGE SYSTEM PERFORMANCE AND COST
R. D. Hay, A. R. Millner, and P. O. Jarvinen 1980 6 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/92; CONF-800806-22) Avail: NTIS HC A02/MF A01

A subscale prototype of a flywheel energy storage and conversion system for use with photovoltaic power systems of residential and intermediate load-center size was designed, built and tested. System design, including details of such key components as magnetic bearings, motor generator, and power-conditioning electronics, are described. Performance results of prototype testing are given and indicate that this system is the equal of or superior to battery and inverter systems for the same application. Results of cost and user-worth analysis show that residential systems are economically feasible in stand-alone and in utility-interactive applications. DOE

N80-32875# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
Richard H. Bube Oct. 1979 25 p refs Prepared in cooperation With Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SU-DSE-4042-T12; QPR-2) Avail: NTIS HC A02/MF A01

The closed tube horizontal growth method was pursued for the growth of single crystals of Zn3P2. The rate of material transport was increased by increasing the temperature difference between source and growth regions and by decreasing the distance involved. A boule with only 2 grains in a 12 mm diameter was obtained. Only small photoresponse was obtained with these totally experimental cells. The Zn3P2 films deposited on glass by CSVT were shown to be amorphous whereas those deposited on single crystal CdS were polycrystalline. Laser anealing was shown to have dramatic effects in crystallizing Zn3P2 films deposited on Si3N4 film substrates on single crystal Si. Thin films of Zn3P2 were deposited on glass substrates by vacuum evaporation. Optical transmission and reflection spectra, as well as photoconductivity spectral response were measured on a number of these films. DOE

N80-32876# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS Quarterly Progress Report, 26 Feb. - 30 Jun. 1979
Richard H. Bube Jul. 1979 10 p refs Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SU-DSE-4042-T10; QPR-1) Avail: NTIS HC A02/MF A01

A closed tube method was developed for the synthesis of Zn3P2 from the elements which eliminates the potential dangers associated with high P pressures. Subsequent materials synthesis will be done routinely by this method. Initial efforts at single crystal growth of Zn3P2 from this material yielded polycrystalline material because of nucleation along the walls of the tube. Techniques for improving the situation are being tested. Progress is reported on the development of a CVD apparatus for the deposition of wide bandgap oxides and sulfides on a variety of substrates including Zn3P2. Layer deposition by the close spaced vapor transport method to be applied to Zn3P2 was successfully tested using CdTe on both quartz and CdS substrates. DOE

N80-32877# United Technologies Corp., South Windsor, Conn. Power Systems Div.
ADVANCED TECHNOLOGY FUEL CELL PROGRAM Annual Report
J. A. S. Bett, C. L. Bushnell, R. F. Buswell, G. A. Gruver, J. M. King, and H. R. Kuna 1980 116 p refs
(EPRI-EM-1328) Avail: NTIS HC A06/MF A01

Efforts were undertaken to establish a basis for the engineering development of an improved fuel cell power plant. These focused on molten carbonate fuel cells, advanced reformers, and use of coal products. Molten carbonate cell configurations were developed that are capable of enduring thermal cycles and were demonstrated in square foot stacks of 8 and 20 cells. Subscale cells were tested at pressures of up to 5 atmospheres with little, if any, carbon or methane formation in the fuel cell. In addition, an adiabatic, a hybrid, and a cyclic reformer were evaluated. DOE

N80-32878# Diamond Shamrock Chemical Co., Cleveland, Ohio. Electrolytic Systems Div.
OXYGEN ELECTRODES FOR ENERGY CONVERSION AND STORAGE Annual Report, 1 Oct. 1977 - 30 Sep. 1978
1980 362 p refs
(Contract EC-77-C-02-4146)
(DOE/ET-25502/1) Avail: NTIS HC A16/MF A01

Very active oxygen electrocatalysts and their incorporations into high performance electrode structures were developed. These long life oxygen electrodes were designed for a spectrum of applications including industrial electrolysis, fuel cells, and metal air batteries. The operating life and initial cost of oxygen cathodes was developed. T.M.

N80-32879# Oak Ridge National Lab., Tenn.
THERMAL ENERGY STORAGE FOR BUILDING HEATING AND COOLING APPLICATIONS Technical Progress Report, Apr. 1979 - Mar. 1980
J. F. Martin and H. W. Hoffman Jun. 1980 65 p refs
(Contract W-7405-eng-26)
(ORNL-TM-7319) Avail: NTIS HC A04/MF A01

The ORNL program in thermal energy storage (TES) over the past year is reported. The program consists of developing sensible and latent heat technologies to meet the single goal of reduction in oil and gas consumption for residential and space conditioning. Three specific application elements were addressed: utility load management, solar energy applications; and conservation. Programs (both completed and ongoing) are summarized, and their relationship to the specific implementation plan are given. The program completed a transition from low temperature storage development including seasonal storage in natural aquifers to TES development for building heating and cooling applications. DOE

N80-32880# Oak Ridge National Lab., Tenn. Energy Div.
ANNUAL CYCLE ENERGY SYSTEM (ACES) Performance Report, Nov. 1977 - Sep. 1978
A. S. Holman and L. A. Abbatiello May 1980 77 p refs
(Contract W-7405-eng-26)
(ORNL/CON-42) Avail: NTIS HC A05/MF A01

A single family residence near Knoxville, Tennessee, is being used to demonstrate the energy conserving features of the annual cycle energy system (ACES), an integrated heating and cooling system that utilizes a unidirectional heat pump and low temperature thermal storage. A second house, the control house, is being used to compare the performance of the ACES with that

of an electric resistance heating and hot water system combined with a central air conditioning system. The ACES reduced peak utility system demands significantly: a reduction from 11.7 to 3.1 kW was achieved in the winter and from 4.1 to 0.7 kW in the summer. The only problems encountered were a heat leak into the storage bin that was twice the calculated value and control logic errors that produced excessive hot water in the winter, requiring extensive use of the night heat rejection mode in the summer. These problems are currently being corrected. DOE

N80-32881# Westinghouse Electric Corp., Pittsburgh, Pa.
OPEN-CYCLE MHD SYSTEMS ANALYSIS Final Report
T. E. Lippert and K. D. Weeks Feb. 1980 511 p refs
(EPRI Proj. 640-1)
(EPRI-AP-1316) Avail: NTIS HC A22/MF A01

Five variant configurations of a coal burning open cycle magnetohydrodynamic electric power generating facility were studied for evaluation as candidate first generation power plants. A material and energy balance and cycle analysis was performed for each case to provide information for the conceptual designs and costing of all major MHD related components and subsystems as well as specification of other state of the art components. A economic comparison was made of each design by developing the cost of electricity based on component costs, estimates of operation and maintenance requirements, and the performance of each plant from the system analyses. An overall description of each plant is provided along with discussions of critical component and process development. An oxygen enriched OCMHD plant design was identified as an attractive candidate for first generation utility service. This plant design appears to offer competitive costs of electricity and minimizes development risk. DOE

N80-32882# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
DEVELOPMENT OF CELLULOSE FLYWHEEL ROTORS Final Report
Arthur G. Erdman, David L. Hagen, and Darrell A. Frohrib Mar. 1980 105 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-79-7099) Avail: NTIS HC A06/MF A01

The primary tasks addressed were the design and development of durable hub-to-rotor attachments and the balancing and vibrational analysis of the resulting hub rotor systems, and measuring and analyzing the strength distributions and durabilities of different types of plywood and of hub rotor systems. In accomplishing these tasks, a metallic hub to cellulose rotor bonding attachment was designed which utilizes a flexible scalloped metal band in lieu of the traditional elastomeric layers to accommodate the differential strain between rotor and hub. A self centering dynamic balancer was designed to automatically locate the inertial axis of a rotor. In analyzing rotor vibrations, a nondimensional design parameter was derived which correlates the support flexibility required to the usable strength and length of the rotor for a useful operating range above the transverse critical frequency. DOE

N80-32883# Brookhaven National Lab., Upton, N. Y. Technology Assessment Group.
REFERENCE ENERGY SYSTEMS AS APPLIED TO REGIONAL ENERGY POLICY
A. Hermelee Dec. 1979 26 p refs
(Contract EY-76-C-02-0016)
(BNL-26987) Avail: NTIS HC A03/MF A01

Reference Energy Systems (RES) was developed for the region serviced by the Tennessee Valley Authority for a base time period and projections developed for the years 1985 and 2000. The RES is a network representation of the technical activities required to supply various forms of energy to end-use activities. Technologies are defined for all operations involving specific fuels including resource extraction, refinement, conversion, transportation, distribution, and utilization. The impact of a new technology in terms of resource consumption may be evaluated by modifying the energy flow paths in a region to incorporate the new technology. Alternate paths through the network reflect the substitutability of resources and technologies for one another. DOE

N80-32884# Solarex Corp., Rockville, Md.
INVESTIGATION OF THE IMPURITY TOLERANCE OF SEMICRYSTALLINE SILICON SOLAR CELLS: SILICON IMPACT PROGRAM Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
G. Storti, W. Regnault, and S. Johnson 1980 23 p refs
(Contract DE-AC02-77CH-00178)
(DSE-4042-T41; QTPR-1) Avail: NTIS HC A02/MF A01

A Veeco resistance heated Czochralski crystal growing furnace was redesigned to allow for the in situ casting of semicrystalline silicon ingots. The casting technique employed is based upon the Bridgeman technique of crystal growth. Samples of metallurgical grade silicon were obtained and preparation of this material began for incorporation into the experimental castings. Initial casting experiments commenced using pure semiconductor grade silicon to establish a base line process for later experiments which will employ metallurgical grade silicon. DOE

N80-32885# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
ANALYSIS OF A PASSIVE HEAT PIPE COOLED SOLAR PHOTOVOLTAIC RECEIVER
K. T. Feldman, Jr. and D. D. Kenney May 1980 97 p refs Prepared in cooperation with Energy Engineering, Inc., Albuquerque, N. Mex. Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-7011) Avail: NTIS HC A05/MF A01

A design study to analyze the performance of an aluminum heat pipe for passive cooling of photovoltaic cells is presented. The heat pipe vessel is an aluminum extrusion with a wedge shaped cross section. The solar cells are mounted on the lower surface where they are irradiated by a parabolic trough solar concentrator. The maximum solar cell temperature is 140 C. Heat is removed from the condenser surface by convection to the ambient air at 40 C. Working fluid selection, heat pipe analysis, and method of performance calculations are described. DOE

N80-32886# Motorola, Inc., Phoenix, Ariz. Solar Operations.
SILICON CONCENTRATOR SOLAR CELL MANUFACTURING DEVELOPMENT
L. Grenon May 1980 174 p Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-7018) Avail: NTIS HC A08/MF A01

A manufacturing development program was conducted in which silicon concentrator solar cells designed to operate at 50 suns were produced. The purpose of this program was to determine the various design requirements for the cell at concentration, develop the manufacturing processes necessary to fabricate the solar cell, and fabricate a total of 2000 solar cells of two separate geometries. A technical analysis was performed to determine those parameters that affect the performance of a silicon concentrator solar cell. For the purposes of this contract, this analysis was limited to solar concentrations up to 50 suns. Included in the analysis are examinations of the base and emitter regions, surface effects, spectral response, and specific design criteria for both type 1 and type 2 concentrator solar cells. Based on the design requirements, a manufacturable process was developed and cells were fabricated. DOE

N80-32887# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
LINE-FOCUS SOLAR THERMAL ENERGY TECHNOLOGY DEVELOPMENT. REPORT FOR DEPARTMENT 4720 Annual Report
Kenneth D. Bergeron, ed., Roscoe L. Champion, ed., and Robert W. Hunke, ed. Apr. 1980 144 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0865-Rev) Avail: NTIS HC A07/MF A01

The primary role of the Solar Energy Projects Department 2 is the development, evaluation, and testing of lime focus solar thermal technology. This report is divided into two parts: (1) component and subsystem development including the design and analysis of collector modules, their components, and associated materials and processes; and (2) systems and applications

development, involving larger configurations of solar thermal line focus systems. The emphasis is on parabolic troughs, but significant efforts on hemispherical bowls, compound parabolic collectors, and dishes for the Solar Total Energy Project are also described. DOE

N80-32888# Midwest Research Inst., Golden, Colo.
PLANNING FOR ELECTRIC UTILITY SOLAR APPLICATIONS: THE EFFECTS ON RELIABILITY AND PRODUCTION COST ESTIMATES OF THE VARIABILITY IN DEMAND
George R. Fegan and C. David Percival Jan. 1980 14 p refs Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC02-76CH-00178)
(SERI/TP-351-545; CONF-800804-18) Avail: NTIS HC A02/MF A01

Previous studies showed the necessity for the consideration of hourly variability in the output from the intermittent generation source. However, the studies did not take into account the variability in the demand. A result is presented which shows that under general conditions the variability due to randomness can be ignored except in the neighborhood of the peak and minimum demands. DOE

N80-32889# Rocket Research Corp., Redmond, Wash.
CHEMICAL ENERGY STORAGE FOR SOLAR THERMAL CONVERSION Final Report
Richard D. Smith, D. R. Poole, C. H. Li, D. K. Carlson, and D. R. Peterson 27 Apr. 1979 99 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-8198; RRC-80-R-678) Avail: NTIS HC A05/MF A01

The technical and economic aspects of using reversible chemical reactions to store energy in Solar Thermal Electric Conversion (STEC) facilities were studied. The study included identification of nine promising chemical reactions from a list of over 550 candidates, preliminary process designs of energy storage subsystems based on these nine reactions, and extensive systems studies of autonomous and hybrid STEC plants with energy storage subsystems based on the reversible oxidation of SO2. The systems studies used a detailed simulation, based on a year long, hour by hour energy balance, of a central receiver STEC facility. Over a range of alternate energy cost and geographic location, the optimum busbar energy costs from autonomous STEC plants were 15 to 90% higher than those from hybrid plants. Optimum storage requirements of autonomous STEC plants were in the range of 200 to 400 hours, while those for hybrid plants were in the range of 15 to 30 hours. DOE

N80-32890# ARCO Solar, Inc., Chatsworth, Calif.
DESIGN AND FABRICATION OF COMBINED PHOTOVOLTAIC-THERMAL COLLECTORS
May 1980 54 p
(Contract DE-AC04-76DP-00789)
(SAND-79-7008) Avail: NTIS HC A04/MF A01

Two water-cooled and two air-cooled modules were designed, fabricated, and tested. Module designs were developed which effectively combined photovoltaic cell and module technology with solar thermal module technology, with minimum modification. The combined modules were designed to be mechanically interchangeable with production solar thermal modules. This design approach was selected to minimize installation and reliability problems, and to reduce costs of combined modules by minimizing new tooling requirements. Both the electrical and thermal performance of the experimental modules was lower than calculated during the design phase of the program, and lower than required by the Sandia specification. DOE

N80-32891# BDM Corp., McLean, Va.
PHOTOVOLTAIC APPLICATIONS DEFINITION AND PHOTOVOLTAIC SYSTEM DEFINITION STUDY IN THE AGRICULTURAL SECTOR. VOLUME 3. APPENDIXES Final Report
R. W. Mengel, T. P. Nadolski, D. C. Sparks, S. K. Young, and A. Yingst May 1980 221 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7018/3) Avail: NTIS HC A10/MF A01

A description of energy consumption for representative farm operations, design and simulation of ventilation for livestock shelters; irrigation systems and calculations; and detailed methodology for selecting multifunction PV system applications are presented. Hourly load data for the chosen farm operations; sample linear programming solution output format; life cycle cost calculation; and illustrative monthly load data for applications analysis and equipment data for applications analysis are also discussed. DOE

N80-32892# Barber-Nichols Engineering Co., Arvada, Colo.
SOLAR POWERED RANKINE CYCLE IRRIGATION PUMP Final Report
William D. Batton and Robert E. Barber Sep. 1979 87 p refs
(Contract DE-AC03-78ET-20419)
(DOE/ET-20419/1; SAN-0419-1) Avail: NTIS HC A05/MF A01

Results of a test program where a small (288 square feet) collector field was installed and used for boiling-in-the-collector tests with R-113 as a working fluid are presented. Two different types of parabolic trough tracking collectors were purchased and tested. There were two rows (128 sq ft) of Del Manufacturing collectors and one row (160 sq ft) of Solar Kinetics collectors. All three rows were installed at a 5 degree angle (inclined to the South) oriented North-South and tracking East-West on the roof at Barber-Nichols in Arvada, Colorado. These two types of collectors have distinct differences that made it worthwhile to test each type. A Rankine engine, less turbine expander, was installed and used to complete a solar power system. The major experimental results are that the collectors did heat the R-113, did provide a vapor suitable for turbine feed, and stable flow did occur under all conditions, thus proving the feasibility of the boiling-in-collector concept. DOE

N80-32893# Bechtel National, Inc., San Francisco, Calif.
COMBINED CYCLE SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM STUDY. VOLUME 3: APPENDICES Final Technical Report
Nov. 1979 177 p refs
(Contract ET-78-C-03-2051)
(DOE/ET-21050/1-3-Vol-3) Avail: NTIS HC A09/MF A01

A design study for a 100 MW gas turbine/steam turbine combined cycle solar/fossil fuel hybrid power plant is presented. The appendices contain: (1) preconceptual design data; (2) market potential analysis methodology; (3) parametric analysis methodology; (4) EPGS system description; (5) commercial-scale solar hybrid power system assessment; and (6) conceptual design data lists. DOE

N80-32894# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
FLUID TEMPERATURE CONTROL FOR PARABOLIC TROUGH SOLAR COLLECTORS
Rudolph Schindwolff 1980 27 p refs Presented at the Joint Autom. Control Conf., San Francisco, 13 Aug. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2006C; CONF-800805-2) Avail: NTIS HC A03/MF A01

Techniques for controlling the temperature of the heat transfer fluid in parabolic trough solar collectors fields were studied by computer simulation. In particular, the rather stringent temperature control requirements associated with thermal electric power generation or cogeneration systems are addressed. Computer models representing the fluid temperature dynamics of the collectors and interconnecting piping were developed and integrated with dynamic models of control elements to obtain a closed loop control system simulation. A specific control configuration was chosen consisting of a flow control valve and one or more temperature sensors to control the flow in each row of collectors. Various control algorithms were evaluated for stability and static errors, and time responses to startup transients and to partial and full collector cloud shadowing transients were obtained. The results indicated that the temperature control requirements can be satisfied using readily available components. DOE

N80-32895# Sandia Labs., Albuquerque, N. Mex. Experimental Aerodynamics Div.

PARABOLIC TROUGH SOLAR COLLECTOR WIND LOADING

Duane E. Randall, Donald D. McBride, and Roger E. Tate 1980 54 p refs Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 18-20 Aug. 1980

(Contract DE-AC04-76DP-00789)

(SAND-79-2134C; CONF-800804-16) Avail: NTIS HC A04/MF A01

Two wind tunnel force and moment tests conducted on parabolic trough solar collector configurations are discussed. The two tests were conducted in different flow field environments, one a uniform flow infinite airstream, the second a simulated atmospheric boundary layer flow with the models simulating a ground mounted installation. The force and moment characteristics of both isolated single module troughs and of trough modules within array configurations were defined over both operational and stow attitudes. The influence of various geometric design parameters for collector modules and arrays was established. Data indicate that forces and moments increase with mounting height and with trough aspect ratio. Collector modules interior to large arrays experience wind force reductions as high as 50 to 65%, while appropriate fences or berms surrounding the arrays can provide exterior modules with protection of this order. DOE

N80-32896# Chicago Univ., Ill.

FUNDAMENTALS AND TECHNIQUES OF NONIMAGING OPTICS FOR SOLAR ENERGY CONCENTRATION Final Report

Roland Winston and Joseph J. Gallagher 20 May 1980 51 p refs

(Contract DE-AS02-78ER-04657)

(DOE/ER-04657/2) Avail: NTIS HC A04/MF A01

The properties of a variety of new and previously known nonimaging optical configurations were investigated. A thermodynamic model which explains quantitatively the enhancement of effective absorptance of gray body receivers through cavity effects was developed. The classic method of Liu and Jordan, which allows one to predict the diffuse sunlight levels through correlation with the total and direct fraction was revised and updated and applied to predict the performance of nonimaging solar collectors. The conceptual design for an optimized solar coolector which integrates the techniques of nonimaging concentration with evacuated tube collector technology was carried out and is presently the basis for a separately funded hardware development project. DOE

N80-32897# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

LOW-COST FLYWHEEL DEMONSTRATION PROGRAM Final Report, 1 Oct. 1977 - 31 Dec. 1979

D. W. Rabenhorst, T. R. Small, and W. O. Wilkinson Apr. 1980 109 p refs

(Contract DE-AC01-77ET-26931)

(DOE/ET-26931/T1; SDO-5540) Avail: NTIS HC A06/MF A01

The Applied Physics Laboratory/Department of Energy Low Cost Flywheel Demonstration Program was initiated and all primary objectives were successfully achieved as follows: demonstration of a full-size, 1 kWh flywhel having an estimated cost in large volume production of approximately $50/kWh; development of a ball bearing system having losses comparable to the losses in a totally magnetic suspension system; and successful and repeated demonstration of the low cost flywheel in a complete flywheel energy storage system based on the use of ordinary house voltage and frequency. Application of the experience gained in the hardware program to project the system design into a complete, full scale, 30 kWh home type flywheel energy storage system was also completed. DOE

N80-32898# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

RESEARCH AND DEVELOPMENT FOR INERTIAL ENERGY STORAGE BASED ON A FLEXIBLE FLYWHEEL Final Report

John M. Vance Jun. 1980 50 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.

(Contract DE-AC04-76DP-00789)

(SAND-79-7097) Avail: NTIS HC A03/MF A01

A design concept for a nonrigid energy storage flywheel suitable for home or farm use was investigated. The distinguishing feature of this flexible flywheel is its construction from high strength fibers (such as synthetic rope) with no bonding agent. The flexible flywheel is self balancing safe, has a high energy density capability (60 Wh/lb), and should be simple and economical to manufacture. A gimbal support system which stabilizes the flywheel without the need for a squeeze film damper was designed, analyzed, and tested. The conceptual design was developed for a flexible flywheel energy storage system suitable for interfacing with a small scale solar energy source. Cost estimates were prepared for the system in the 10 KWh and 50 KWh sizes. DOE

N80-32899# Battelle Northwest Labs., Richland, Wash.

SEASONAL THERMAL ENERGY STORAGE Program Progress Report, Apr. - Dec. 1979

J. E. Minor Mar. 1980 59 p Prepared in cooperation with Tennessee Valley Authority, Chattanooga; Texas A and M Univ., College Station; Washington State Univ., Pullman; Auburn Univ., Ala.; California Univ., Lawrence Berkeley Lab.; ORNL, Tenn.; Terra Tek, Inc., Salt Lake City

(Contract DE-AC06-76RL-01830)

(PNL-3322) Avail: NTIS HC A04/MF A01

The Seasonal Thermal Energy Storage (STES) Program demonstrates the economic storage and retrieval of thermal energy on a seasonal basis, using heat or cold available from waste or other sources during a surplus period to reduce peak period demand, reduce electric utilities peaking problems, and contribute to the establishment of favorable economics for district heating and cooling systems for commercialization of the technology. The STES Program utilizes ground water systems (aquifers) for thermal energy storage. The STES Program is divided into an Aquifer Thermal Energy Storage (ATES) Demonstration Task for demonstrating the commercialization potential of aquifer thermal energy storage technology using an integrated system approach to multiple demonstration projects and a parallel Technical Support Task designed to provide support to the overall STES Program, and to reduce technological and institutional barriers to the development of energy storage systems prior to significant investment in demonstration or commercial facilities. DOE

N80-32900# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

COSTING METHODOLOGIES FOR ENERGY SYSTEMS

Jack Allentuck, Vinod Mubayi, and Ann W. Reisman Nov. 1979 23 p refs Presented at Conf. on Long-Term Energy Resources, Montreal, 3 Dec. 1979

(Contract DE-AC02-76CH-00016)

(BNL-27603; CONF-791216-3) Avail: NTIS HC A02/MF A01

The problem of devising a methodology for arriving at costs of systems which may be used to compare alternative sources was addressed. The basic elements of such a methodology were examined. Diverse subjects such as resource supply curves, experience and learning, and the cost of environmental pollution were investigated. DOE

N80-32901# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

SIMULATION MODEL FOR ASSESSING BUILDING ENERGY-CONSERVATION POLICIES

Peter T. Kleeman May 1980 13 p refs Presented at 11th Ann. Conf. on Modeling and Simulation, Pittsburgh, 1-2 May, 1980

(Contract DE-AC02-76CH-00016)

(BNL-27802; CONF-800549-2) Avail: NTIS HC A02/MF A01

A multiple-region simulation model for estimating economic, environmental, and energy-related impacts of building energy-conservation policies is presented. The model is formulated as a time-stepped sequence of optimization subproblems, each reflecting building energy-conservation options and energy costs, and identifying optimal investments and energy consumption for the time step. DOE

N80-32902# Auburn Univ., Ala. Dept. of Mechanical Engineering.

OPERATOR MANUAL: HIGH TEMPERATURE HEAT PUMP
David F. Dyer, Glennon Maples, Thomas E. Burch, and Paul D. Chancellor 4 Mar. 1980 66 p
(Contract DE-AC01-79CS-40163)
(DOE/CS-40163/T1) Avail: NTIS HC A04/MF A01

Experimental data were obtained from operating a high temperature heat pump system. The use of methanol as a working fluid necessitated careful monitoring of refrigerant temperatures and pressures with chemical analysis performed on the working fluid during scheduled down time. Materials sent to vendors and quotes received concerning equipment (compressor, evaporator, condensor, air heater, dryer, two accumulator tanks, and three expansion valves) are discussed. The detailed design and pricing estimates are included. Additional information on layout and construction; start-up; testing; shut down; scheduled maintenance and inspection; safety precautions; control system; and trouble shooting is presented. DOE

N80-32903# Lockheed Missiles and Space Co., Palo Alto, Calif.
ROLE OF MICROCOMPUTERS IN SECONDARY BATTERY DEVELOPMENT AND TESTING
Roger P. Hollandsworth and George B. Adams 11 Dec. 1979 138 p refs
(Contract W-7405-eng-48)
(UCRL-15171; LMSC-D681058) Avail: NTIS HC A07/MF A01

A low cost dedicated microcomputer system to secondary battery development and testing was developed. An overview of computers, hardware, and software is given. The particular application discussed is the zinc/ferricyanide hybrid redox battery. The system is capable of controlling the charge and discharge cycles of six or more secondary batteries based upon five or more operator determined cell parameters, and computing at the end of each cycle the voltaic, coulombic, and energy conversion efficiencies for each cell. The system described fulfills the objective of enabling one person to control, collect, and interpret cyclic data from many cells with a minimum of effort. DOE

N80-32904# Oak Ridge National Lab., Tenn. Energy Div.
THEORY AND DESIGN OF AN ANNUAL CYCLE ENERGY SYSTEM (ACES) FOR RESIDENCES
E. A. Nephew, L. A. Abbatiello, and M. L. Ballou May 1980 357 p refs
(Contract W-7405-eng-26)
(ORNL/CON-43) Avail: NTIS HC A16/MF A01

The basic concept of the Annual Cycle Energy System (ACES), and integrated system for supplying space heating, hot water, and air conditioning to a building, and the theory underlying its design and operation are described. Practical procedures for designing an ACES for a single family residence, together with recommended guidelines for the construction and installation of system components, are presented. Methods are discussed for estimating the life cycle cost, component sizes, and annual energy consumption of the system for residential applications in different climatic regions of the US. DOE

N80-32905# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
ECONOMIC EVALUATION OF THE ANNUAL CYCLE ENERGY SYSTEM (ACES). VOLUME 1: EXECUTIVE SUMMARY Final Report
May 1980 70 p
(Contract W-7405-eng-48)
(ORNL/Sub-7470/1-V1) Avail: NTIS HC A04/MF A01

Three different classes of building are investigated, namely: single family residence; multifamily residence; and commercial office building. For each building type in each geographic location, the economic evaluation of the annual cycle energy system (ACES) is based on a comparison of the present worth of the ACES to the present worth of a number of conventional systems. The results of this analysis indicate that the economic viability of the ACES is very sensitive to the assumed value of the property tax, maintenance cost, and fuel escalation rates, while it is relatively insensitive to the assumed values of other parameters. Fortunately, any conceivable change in the fuel escalation rates would tend to increase the viability of the ACES concept. An increase in the assumed value of the maintenance cost or property tax would tend to make the ACES concept less viable; a decrease in either would tend to make the ACES concept more viable. DOE

N80-32906# Pennsylvania State Univ., University Park.
ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
G. H. Junkhan, A. E. Bergles, and R. L. Webb Nov. 1979 29 p refs Prepared in cooperation with Iowa State Univ., Ames
(Contract ET-78-S-02-4649)
(COO-4649-10) Avail: NTIS HC A03/MF A01

The theory and practice of heat transfer enhancement are discussed. Technology studies on porous boiling surfaces and enhancement of flow boiling in helically coiled tubes are discussed. DOE

N80-32907# California Univ., Livermore. Lawrence Livermore Lab.
COMPARATIVE ANALYSIS OF ALUMINUM-AIR BATTERY PROPULSION SYSTEMS FOR PASSENGER VEHICLES
J. D. Salisbury, E. Behrin, M. K. Kong, and D. J. Whisler 29 Feb. 1980 103 p refs
(Contract W-7405-eng-48)
(UCRL-52933) Avail: NTIS HC A06/MF A01

Three electric propulsion systems using an aluminum air battery were analyzed and compared to the internal combustion engine (ICE) vehicle. The engine and fuel systems of a representative five passenger highway vehicle were replaced conceptually by each of the three electric propulsion systems. The electrical vehicles were constrained by the computer simulation to be equivalent to the ICE vehicle in range and acceleration performance. The vehicle masses and aluminum consumption rates were then calculated for the electric vehicles and these data were used as figures of merit. The Al-air vehicles analyzed were (1) an Al-air battery only electric vehicle; (2) an Al-air battery combined with a nickel zinc secondary battery for power leveling and regenerative braking; and (3) an Al-air battery combined with a flywheel for power leveling and regenerative braking. All three electric systems compared favorably with the ICE vehicle. DOE

N80-32908# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
LAMINATED, COMPOSITE FLYWHEEL FAILURE ANALYSIS
R. P. Nimmer 6 Jun. 1980 37 p refs
(Contract W-7405-eng-48)
(UCRL-15164) Avail: NTIS HC A03/MF A01

A hybrid, composite flywheel, composed of a laminated, flat S2 glass central disc, with a filament wound, graphite outer ring has been proposed for vehicle application. The failure mechanism of the laminated central disco of this hybrid design is discussed with reference to spin test data, nondestructive ultrasound test data, and supporting failure analysis. DOE

N80-32909# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND TECHNOLOGY REVIEW
Jun. 1980 19 p
(Contract W-7405-eng-48)
(UCRL-52000-80-6) Avail: NTIS HC A02/MF A01

A promising technique for detecting and quantifying the effects of cancer-causing agents in human somatic cells was developed. Using argon X-ray line imaging to measure the ion density of deuterium tritium fuel in an inertial confinement fusion target at the instant of ignition is described. The potential effects on the economy of a complete cutoff of Middle Eastern oil and how we might cope with them are discussed. L.F.M.

N80-32910# Brobeck (William M.) and Associates, Berkeley, Calif.
FABRICATION OF TWO ONE-FIFTH SCALE FIBER COMPOSITE FLYWHEELS Final Report
Apr. 1980 43 p ref
(Contract W-7405-eng-48)
(UCRL-15231; WMB/A-4500-95-25-R1) Avail: NTIS

HC A03/MF A01

Two fiber composite flywheel rotors were fabricated. These flywheels are scaled down versions of two automotive flywheels built for Sandia Laboratories. The flywheels store a maximum of 0.97 kWh of kinetic energy. Energy density is 87 Wh/kg at the maximum operating speed of 56,000 rpm. The nominal flywheel dimensions are 35 cm diameter by 13 cm axial height. The weight of the flywheel rotor assembly is 11.16 kg. DOE

N80-32911# Midwest Research Inst., Golden, Colo.
POTENTIAL FOR SUPPLYING SOLAR THERMAL ENERGY TO INDUSTRIAL UNIT OPERATIONS
E. Kenneth May Apr. 1980 13 p refs Presented at the 89th Ann. Meeting of AICE, Portland, Oreg., 17-20 Aug. 1980
(Contract DE-AC02-77CH-00178)
(SERI/TP-632-584; CONF-800802-3) Avail: NTIS HC A02/MF A01

Adoption of solar thermal technology, considered in terms of the end use of energy delivered to industrial unit operations was studied. The use of low temperature processes, which are more easily integrated with solar thermal technology were studied. The adoption of solar technology is favored by the relative rates of increase of the costs of electricity and natural gas, and by energy conservation measures. High temperature hot water systems are more compatible with solar technology. DOE

N80-32912# Tennessee Univ., Knoxville.
REPAIR AND CELL CYCLE RESPONSE IN CELLS EXPOSED TO ENVIRONMENTAL BIOHAZARDS Progress Report, 1 Jun. 1979 - 31 May 1980
Daniel Billen and Charles T. Hadden 1980 10 p refs Prepared in cooperation with ORNL, Tenn.
(Contract DE-AS05-76EV-04568)
(ORO-4568-26) Avail: NTIS HC A02/MF A01

Topics discussed include: (1) DNA repair in bacillus subtilis; (2) postreplication repair in rec mutants of B. subtilis; (3) photobiology of halogenated DNA; (4) effects of caffeine on pyrimidine dimer excision and postreplication repair in B. subtilis; and (5) DNA repair in toluene treated escherichia coli. DOE

N80-32913# Texas Univ. at Austin. Center for Energy Studies.
MONITORING OF THE PERFORMANCE OF A SOLAR HEATED AND COOLED APARTMENT BUILDING Final Report
Gary C. Vliet and Robert L. Srubar Mar. 1980 95 p refs
(Contract EM-78-S-01-5235)
(DSE-5235-T1) Avail: NTIS HC A05/MF A01

An all electric apartment building in Texas was retrofitted for solar heating and cooling and hot water. The system consisted of an array of 1280 square feet of Northrup concentrating tracking collectors, a 5000 gallon hot water storage vessel, a 500 gallon chilled water storage vessel, a 25 ton Arkla Industries absorption chiller, and a two pipe hydronic air conditioning system. The solar air conditioning equipment was installed in parallel with the existing conventional electric heating and cooling system, and the solar domestic water heating served as preheat to the existing electric water heaters. The system was fully instrumented for monitoring. Detailed descriptions of the solar system, the performance monitoring system, and the data reduction processes are given. DOE

N80-32914# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYTICAL PREDICTION OF THE PERFORMANCE OF AN AIR PHOTOVOLTAIC/THERMAL FLAT PLATE COLLECTOR
P. Raghuraman 30 Apr. 1980 20 p refs
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/93) Avail: NTIS HC A02/MF A01

A one dimensional analysis predicted the electrical and thermal performance of an air photovoltaic/thermal flat plate collector. The analysis compared well with test measurements, predicting the thermal efficiency to within 2 percent. From the analysis, the poor thermal performance of the collector was attributable, in part, to the large undulations of the cell/silicon pottant surface in contact with the flowing air that resulted in less effective convective heat transfer areas between the cell and the air. DOE

N80-32915# Joint Center for Graduate Study, Richland, Wash.
[INVESTIGATION OF LOW-COST SOLAR CELLS BASED ON Cu2O] Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Larry C. Olsen 12 Mar. 1980 33 p refs
(Contract DE-AC04-79ET-23006)
(DOE/ET-23006/3; QPR-3) Avail: NTIS HC A03/MF A01

In-doped ZnS films with very good optical quality and finite conductivity were obtained by codepositing In and ZnS. Analysis of the internal photoresponse indicated that minority carrier diffusion lengths on the order of 10 micrometers are being achieved with the present Cu2O growth procedure. These devices appear to have an MIS structure or fixed charge at the interface. Another very significant achievement was the development of a surface preparation procedure which results in a nearly perfect stochiometry at the surface. DOE

N80-32916# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
SPECTRAL CHARACTER OF SOLAR AND CIRCUMSOLAR RADIATION
D. B. Evans, D. F. Grether, A. J. Hunt, and M. Wahlig Mar. 1980 6 p refs Presented at the ISES Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract W-7405-eng-48)
(LBL-10802; CONF-800604-25) Avail: NTIS HC A02/MF A01

Information on the solar and circumsolar radiation (the solar aureole) for application to concentrating solar energy systems is discussed. Four instrument systems obtain detailed measurements of the solar and circumsolar intensity, both as a function of angular distance from the center of the Sun, and as a function of wavelength. A method of inverting filtered measurements to obtain the energy contained within a given wavelength interval is presented. Comparisons are made between the atmospheric transmission code LOWTRAN and normal incidence data. The amount of circumsolar radiation and the dependence of circumsolar radiation on angular distance from the Sun are discussed as a function of wavelength for selected atmospheric conditions. DOE

N80-32917# Energy Development Associates, Madison Heights, Mich.
DEVELOPMENT OF THE ZINC-CHLORIDE BATTERY FOR UTILITY APPLICATIONS Progress Report, 1 Apr. 1978 - 31 Mar. 1980
May 1980 407 p refs
(EPRI-EM-1417) Avail: NTIS HC A18/MF A01

Significant accomplishments were: development of a data base on the density, conductivity, viscosity, chlorine solubility, and the zinc transference number for ZnCl2-KCl-NaCl electrolytes; development of a model describing the hydrodynamic phenomena occurring between individual zinc and chlorine electrodes during charge; demonstration of cell electrochemical energy efficiencies of 74% for delivered capacity densities of 500 Wh/cm 2, completion of reliability studies for 100 MWh battery plants that discuss quantitatively plant availability and electricity cost in terms of module failure rate, invention of a module bypass switch concept that isolates a failed module in a series connected string and thereby avoids string outage. A computer model for module operation was also developed that allows prediction of the effects of component changes on module performance. DOE

N80-32918# Department of Energy, Washington, D. C. Office of Current Reporting.
INTERNATIONAL ENERGY INDICATORS
Jun. 1980 40 p
(DOE/IA-0010) Avail: NTIS HC A03/MF A01

Data on the crude oil capacity, production, and shut in of several countries are presented. Petroleum consumption by industrial countries is reported. Natural gas development throughout the world is reported. World reserves of crude oil and natural gas were estimated. T.M.

N80-32919# Virginia Polytechnic Inst. and State Univ., Blacksburg.
CdSiAs2 THIN FILMS FOR SOLAR CELL APPLICATIONS Quarterly Report, 9 Apr. - 30 Jun. 1979
L. C. Burton and L. H. Slack 25 Jul. 1979 51 p refs

(Contract DE-AC04-79ET-23007)
(DOE/ET-23007/1) Avail: NTIS HC A04/MF A01

Near stoichiometric bulk polycrystalline CdSiAs2 was synthesized by two techniques: (1) direct fusion of the elements and (2) direct fusion of the binaries SiAs, Cd3As2 and CdAs2. The latter technique resulted in denser ternary material with good homogeneity. The above binaries melt congruently and were also formed by direct fusion. Sputtered ternary films were formed using a bulk CdSiAs2 target, and a composite target of CdAs2 discs in a Si plate. Composition of the CdSiAS2 target changed with sputtering time. Amorphous films deposited from that target were heat treated, and became crystalline and near stoichiometric but with poor mechanical properties. It appears that films deposited from the composite target (Si + CdAs2) can be adjusted to stoichiometry by means of sputtering power and target geometry. As deposited, these films also were amorphous. DOE

N80-32920# State Univ. of New York, Buffalo. Dept. of Electrical Engineering.
DEPOSITION, FABRICATION AND ANALYSIS OF POLY-CRYSTALLINE SILICON MIS SOLAR CELLS Final Report, 1 Jan. - 31 Dec. 1979
Wayne A. Anderson Mar. 1980 112 p refs
(Contract DE-AC03-79ET-23044)
(DOE/ET-23044/4) Avail: NTIS HC A06/MF A01

MIS cell fabrication techniques, protovoltaic response data, I-V-T analysis to reveal conduction mechanisms, a detailed computer model, optimum MIS solar cell design, surface state effects, Auger studies, reliability studies and e-beam deposition of thin silicon films are discussed. The most important features include the one pump down fabrication process, establishing a consistent fabrication sequence, achieving 13% efficiency of 2 sq cm area, an evaluation of conduction mechanisms, establishing a detailed computer model, and setting up an improved e-beam system to deposit thin silicon films. DOE

N80-32921# RCA Labs., Princeton, N. J. Display and Energy Systems Research Lab.
AMORPHOUS THIN FILMS FOR SOLAR-CELL APPLICATIONS Final Report
D. E. Carlson, R. W. Smith, I. Ballberg, R. S. Crandall, B. E. Thompkins, J. Dresner, B. C. Goldstein, D. J. Szostak, J. J. Hanak, J. P. Pellicane et al Feb. 1980 176 p refs
(Contract DE-AC03-78ET-21074)
(DOE/ET-21074/4; PRRL-79-CR-47) Avail: NTIS HC A09/MF A01

Theories for the capture of electrons by deep centers in hydrogenated amorphous silicon (a-Si:H) and for field dependent quantum efficiency in a-Si:H are presented. The optimization of phosphorus-doped a-Si:H carried out in four different discharge systems is described. Some details of the dc proximity and rf magnetron discharge systems are also provided. Preliminary mass spectroscopy studies of the rf magnetron discharge in both SiH4 and SiF4 are presented. Measurements of the surface photovoltage were used to estimate the distribution of surface states of phosphorus-doped and undoped a-Si:H. A detailed description of carrier generation, recombination, and transport in a-Si:H solar cells is given. Finally, some characteristics of Pd-Schottky-barrier cells are described for different processing histories. DOE

N80-32922# Miami Univ., Coral Gables, Fla. Clean Energy Research Inst.
ASSESSMENT OF HYDROGEN COMPRESSOR TECHNOLOGY FOR ENERGY STORAGE AND TRANSMISSION SYSTEMS Final Report
Laxman G. Phadke, T. Nejat Veziroglu, Richard W. Foster, and William J. D. Escher Jan. 1979 192 p refs Prepared in cooperation with Escher Technology Associates, St. Johns, Mich.
(Contract EC-77-S-05-5598)
(ORO-5598-T1) Avail: NTIS HC A09/MF A01

An initial assessment of hydrogen compressor technology for prospective energy systems applications is documented. Hydrogen, and hydrogen/natural gas blends, are generally related to the existing state of the art in natural compressors. Visits to natural gas transmission and storage facilities are reported on from the compressor applications standpoint. Present applications of hydrogen compressors, as reported by both manufacturers and users are summarized. Theoretical fluid dynamic and thermodynamic analysis of these fuel gases in compressors is provided. The implications of materials problems considered relevant to compressors are briefly discussed. Some general observations and recommendations are presented. DOE

N80-32923# RCA Labs., Princeton, N. J.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SILICON SOLAR CELLS Quarterly Report, 1 Sep. - 30 Nov. 1979
David Redfield Dec. 1979 23 p refs
(Contract DE-AC01-79ET-23108)
(DOE/ET-23108/2; QR-2) Avail: NTIS HC A02/MF A01

The effects of Auger recombination on the saturation current density of heavily doped semiconductors are shown to be more far reaching than was recognized. The equation generally used to predict and evaluate the saturation current in Si junctions always becomes invalid in the heavily doped cases of interest. The new procedure for determining J sub o was improved in two ways that now permit the identification of qualitative trends in J sub o in a significant manner. Experiments relating doping gradient effects to surface properties of Si solar cells provided new data on this relationship and led to the development of a simple new method for evaluating antireflection coatings. DOE

N80-32924# RCA Labs., Princeton, N. J.
LOW-COST EPITAXIAL TECHNIQUES FOR SOLAR-CELL FABRICATION Quarterly Technical Progress Report, 26 Sep. 1979 - 24 Dec. 1979
R. V. Daiello and P. H. Robinson Jan. 1980 27 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(SERI/PR-82741-1; QTPR-1) Avail: NTIS HC A03/MF A01

A candidate low cost silicon substrate, designated upgraded metallurgical grade (UMG) silicon, was obtained. The electrical, physical, and structural properties of three grades of this material were measured. An initial epitaxial growth technique was standardized and qualified for application to the growth of diagnostic and solar cell structures. Such structures were grown on the three UMG grades of substrates and the properties of these layers were compared to those of the substrates. The defect density in the epitaxial films was lower than in the substrates, but greater aerial variation was observed for the less pure, multicrystalline grades of substrates. Solar cells were fabricated in epitaxial structures grown on all three UMG grades of substrates. DOE

N80-32925# Grumman Aerospace Corp., Bethpage, N.Y.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS CdSe THIN FILM ELECTRODES Quarterly Progress Report, Jun. - Aug. 1979
M. A. Russak and C. Creter Sep. 1979 34 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T16; QPR-1) Avail: NTIS HC A03/MF A01

Conversion efficiencies in the range of 10% with electrochemical cells utilizing thin film electrodes were obtained. A CdSe/aqueous sulfide polysulfide system was studied. Results of the initial CdSe deposition parameter study are given. The ratio of Se and Dc in the as deposited film has marked effect on the film's chemical, microstructural, optical, and electrical properties. DOE

N80-32926# California Univ., Livermore. Lawrence Livermore Lab. Chemical Engineering Div.
SOLAR GASIFICATION OF CHARCOAL, WOOD AND PAPER
R. W. Taylor, Rene Berjoan (CNRS, Font Romeu, France), and J. P. Coutures (CNRS, Font Romeu, France) 20 May 1980 15 p Presented at User's Assoc. Annual Meeting, Las Cruces, N. Mex., 15-17 Apr. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84411; CONF-800481-1) Avail: NTIS HC A02/MF A01

Charcoal, wood and paper were gasified in a 2 kW solar furnace by injecting water directly on the hot fuel. In the case of charcoal, approximately 30% of the incident solar energy was

stored as chemical energy and 55% of the injected water was consumed. Wood and paper gasification are explained by conventional pyrolysis followed by the gasification of the charcoal formed. DOE

N80-32927# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
RESEARCH ON Cu SUB x S/(Cd, Zn)S PHOTOVOLTAIC SOLAR ENERGY CONVERTERS Final Report, Mar. 1977 - Sep. 1979
B. L. Chin, T. M. Peterson, U. Dahmen, K. Seshan, L. E. Sindelar, and J. Washburn Mar. 1980 119 p refs
(Contract W-7405-eng-48)
(LBL-10791) Avail: NTIS HC A06/MF A01

The factors affecting the operation of CdS/Cu/sub x/S and (Cd,Zn)S/Cu/sub x/S photovoltaic cells were studied. The approach was to systematically study the single crystal heterojunction so as to eliminate the complicating effects of grain boundaries. Single crystal CdS and (Cd,Zn)S thin films were deposited onto both GaAs and Ge substrates by a hot wall vacuum deposition technique. These grown films were studied using X-ray diffraction, SEM-EDAX, TEM and Hall Effect experiments. Information concerning the effects of varying processing parameters on the chemical and structural nature of the deposited films was obtained. Detailed TEM studies revealed the presence of different dislocation structures which affect the cell performance. The relationship between structural information and cell operation was studied. DOE

N80-32928# Argonne National Lab., Ill.
SATELLITE POWER SYSTEMS (SPS) COST REVIEW
J. H. Crowley and E. J. Ziegler May 1980 89 p refs
(Contract W-31-109-eng-38)
(DOE/TIC-11190) Avail: NTIS HC A05/MF A01

Estimated costs for three selected SPS designs were determined. One SPS concept uses silicon solar cells with a concentration ratio of one; the second uses gallium arsenide solar cells with a concentration ratio of two; and the third (reference) design incorporates features of the first two. The systems within the SPS designs chosen include: rectenna construction; graphite fiber reinforced thermoplastic structures; solar cells, satellite electrical slip rings; satellite electrical systems; and ground rectenna electrical systems. DOE

N80-32929# Solar Environmental Engineering Co., Inc., Fort Collins, Colo. SOLOCOST Service Center.
SOLAR INDEX GENERATION AND DELIVERY
Loren J. Lantz 1980 97 p refs
(Contract DE-AC02-78ET-20090)
(DOE/ET-20090/3) Avail: NTIS HC A05/MF A01

Basically, the Solar Index represents the percentage of energy that solar would provide in order to heat an 80 gallon service hot water load for a given location and day. The Index is computed by utilizing SOLOCOST, a computer program, which also has applications to space heating, cooling, and heat pump systems and which supplies economic analyses for such solar energy systems. The Index is generated for approximately 68 geographic locations in the country on a daily basis. The definition of the Index, how the project came to be, what it is at the present time and a plan for the future are described. DOE

N80-32930# Fairchild Space and Electronics Co., Germantown, Md.
DESIGN EVOLUTION AND VERIFICATION OF THE GENERAL-PURPOSE HEAT SOURCE
A. Schock [1980] 11 p
(Contract DE-AC02-77ET-33021)
(DOE/ET-33021/T1) Avail: NTIS HC A02/MF A01

The general purpose heat source employs a modular design. Each 250 W module is completely autonomous, with its own passive safety provisions to prevent fuel release under all abort modes, including atmospheric reentry and Earth impact. This requires high impact temperatures, typically above 900 C and reasonably fine grain size, which in turn requires avoidance of excessive operating temperatures and reentry temperatures. These three requirements - on operating, reentry, and impact temperatures are in mutual conflict, since thermal design changes to improve any one of these temperatures tend to worsen one or both of the others. This design problem was overcome by successive design revisions, supplemented by thermal analyses and confirmatory vibration and impact tests. R.K.G.

N80-32931# Westinghouse Research and Development Center, Pittsburgh, Pa.
DEVELOPMENT OF COPPER SULFIDE/CADMIUM SULFIDE THIN FILM SOLAR CELLS Technical Progress Report, 13 Jul. - 12 Oct. 1979
J. R. Szedon, F. A. Shirland, J. A. Stoll, and H. C. Dickey 14 Feb. 1980 36 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T42; TPR-1) Avail: NTIS HC A03/MF A01

Preparation of CdS films by evaporation from a single graphite source, as generally used by the Institute of Energy Conversion (IEC) group at the University of Delaware, was implemented. Previously, four evaporation sources were used to permit uniform coverage of large area substrates. The graphite source used in this period is somewhat smaller than the IEC design to permit accommodation to the heater geometry currently available. Initial efforts with the single source evaporation were on characterizing the thickness profiles of the deposited films. This is needed to permit selection of conditions for obtaining films of about 30 microns thickness over the central 4 cm x 4 cm area of the substrates. Barrier processing according to the details of IEC method was used on four source CdS films. To date the best cells have only been about 1% efficient. Low short circuit current density values (approximately 5 mA/sq cm) have been the biggest problem. Annealing in 6% H2/Ar mixtures at 170 C after electrode grid evaporation generally has resulted in reduced values of J/sub sc/. DOE

N80-32932# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
CUPROUS OXIDE PHOTOVOLTAIC CELLS Quarterly Technical Progress Report, 9 Jan. - 8 Apr. 1980
Dan Trivich 8 Apr. 1980 37 p refs
(Contract DE-AC04-79ET-23010)
(DOE/ET-23010/17; QTPR-4) Avail: NTIS HC A03/MF A01

Metal insulator semiconductor cells and heterojunction cells with Cu2Owere studied. In particular the junctions were studied by Auger techniques to detect possible chemical changes at the interface. It was found that some preparation conditions could produce heterojunctions without chemical degradation. The effect of impurities in the starting Cu on the properties of the Cu2O and Cu2O solar cell was examined. Methods of measuring diffusion length were explored. DOE

N80-32933# Southern Methodist Univ., Dallas, Tex.
THIN FILMS OF SILICON ON METALLURGICAL SILICON SUBSTRATES Final Report, 1 Sep. 1976 - 30 Sep. 1979
Ting L. Chu Sep. 1979 98 p refs
(Contracts EY-76-C-03-1285; DE-AC03-76ET-20405)
(SAN-1285-T2) Avail: NTIS HC A05/MF A01

Metallurgical silicon was purified by a low cost technique, acid-extraction and phosphorus pentoxide treatment, to yield materials suitable for substrate purposes. Recrystallization techniques were developed to produce large grain silicon sheet supported on graphite. Silicon films of controlled thickness and dopant distribution were deposited on metallurgical silicon substrates, and the properties of silicon films and epitaxial p-n junctions were investigated in detail. Polycrystalline silicon solar cells were fabricated, and their properties including current-voltage characteristics, spectral response, minority carrier diffusion length, dopant profile, and stability, were characterized in detail. The properties of grain boundaries in polycrystalline silicon solar cells were investigated by photoresponse scan and EBIC techniques. DOE

N80-32934# Solarex Corp., Rockville, Md.
INVESTIGATION OF THE IMPURITY TOLERANCE OF SEMICRYSTALLINE SILICON SOLAR CELLS SILICON IMPACT PROGRAM
G. Storti, W. Regnault, S. Johnson, H. C. Lin (Maryland Univ.), and R. W. Armstrong (Maryland Univ.) 31 Mar. 1980 96 p Sponsored by Solar Energy Research Inst.
(Contract DE-AC02-77CH-00178)
(DOE/CH-00178-T2; QTPR-2) Avail: NTIS HC A05/MF A01

Design modifications were made to incorporate thermocouples into the polysilicon casting furnace to allow for the constant monitoring of the temperature profile during the casting process. A source of metallurgical grade (MG) silicon was chosen and the material was prepared by grinding the large pieces into powder. The uniformity of the feedstock was ascertained by optical emission spectrograph analysis of three random samples of the feedstock. A total of sixteen casting runs were made this quarter; Union Carbide CMG graphite was found to be the most suitable crucible material. Solar cells were fabricated from the successful castings (five 100% SG, and two containing 1% and 5% MG silicon, respectively). The average efficiency from the first SG ingot was 10.4% AM0 (in excess of 12% AM1). In general, solar cells fabricated from the top and bottom of the ingots exhibited better overall characteristics. The addition of MG silicon to the casting caused a large degradation in both light and dark I-V characteristics. DOE

N80-32935# Sandia Labs., Albuquerque, N. Mex.
US NATIONAL PHOTOVOLTAICS PROGRAM AND APPLICATIONS EXPERIMENTS IN THE INTERMEDIATE SECTOR
Miguel Rios, Jr. 1980 35 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0587C) Avail: NTIS HC A03/MF A01

The Department of Energy (DOE) commercial readiness goals for photovoltaics technology are summarized and the role of the national labs, research centers, and institutes in the strategy for achievement of these goals is outlined. Some examples of the flatplate and concentrator photovoltaics experiments that are under construction through the DOE Program Research and Development Announcements (PRDAs) are discussed. These experiments establish system feasibility and demonstrate the applicability of photovoltaics as an alternative energy source in the intermediate sector (industrial, commercial, and agricultural). Installed system costs for the proposed PRDAs are given and concentrator technology requirements for achievement of DOE commercial readiness goals are presented. DOE

N80-32936# Sandia Labs., Albuquerque, N. Mex.
GALLIUM ARSENIDE PHOTOVOLTAIC DENSE ARRAY FOR CONCENTRATOR APPLICATIONS
J. J. Wiczer, J. A. Cape, and J. S. Harris, Jr. 1980 16 p refs Presented at the Intern. Symp. of the SPIE, San Diego, Calif., 28 Jul. 1980 Prepared in cooperation with Rockwell International Corp., Thousand Oaks, Calif.
(Contract DE-AC04-76DP-00789)
(SAND-80-1569C; CONF-800719-6) Avail: NTIS HC A02/MF A01

An array of 256 densely packed gallium arsenide (GaAs) solar cells was designed, fabricated and tested to explore the feasibility of operating photovoltaic subsystems at solar central receiver facilities. The design goals, fabrication processes, and observed test results for such a photovoltaic array are reported. DOE

N80-32937# Sandia Labs., Albuquerque, N. Mex.
SIMPLE ECONOMIC EVALUATION AND APPLICATIONS EXPERIMENTS FOR PHOTOVOLTAIC SYSTEMS FOR REMOTE SITES
Miguel Rios, Jr. 1980 47 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0749C) Avail: NTIS HC A03/MF A01

A simple evaluation of the cost effectiveness of photovoltaic systems is presented. The evaluation was based on a calculation of breakeven costs of photovoltaics (PV) arrays with the levelized costs of two alternative energy sources (1) extension of the utility grid and (2) diesel generators. A selected number of PV applications experiments that are in progress in remote areas of the US are summarized. These applications experiments range from a 23 watt insect survey trap to a 100 kW PV system for a national park complex. The PV systems for remote areas are not cost effective in remote small applications with commercially available technology. DOE

N80-32938# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
GALLIUM ARSENIDE PHOTOVOLTAIC DENSE ARRAY FOR CONCENTRATOR APPLICATIONS
J. A. Cape, J. S. Harris, Jr., and J. J. Wiczer (Sandia Labs., Albuquerque, N. Mex.) 1980 14 p Presented at the Am. Sect. of the ISES Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2270C; CONF-800604-32) Avail: NTIS HC A02/MF A01

The design, fabrication, and testing are discussed for a dense array consisting of 16 overlapped linear modules each containing 16 contiguous 1 cm by 1.25 cm GaAs concentrator cells in a row. The overlapping is done so that only active cell area is presented to the concentrated sunlight. The array presents a frontal area of 320 cu cm and is designed to yield a system output of approximately 230 volts at 25 to 25 amps at 1000 SUNs. DOE

N80-32939# A/S International Solar Power Co. Ltd., Gentofte (Denmark).
FEASIBILITY STUDY ON A SOLAR HOUSE HEATING SYSTEM WITH A LOW QUALITY THERMAL FLOW Final Report
A. Eggers-Lura 1980 237 p refs
(EUR-6696-EN) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

A solar energy/heatpump house heating system with a low quality thermal flow, and of integration into prefabricated concrete element buildings were studied. Denmark's energy problem, its energy policy, and its housing and building industry are briefly described. A survey is made of existing buildings in Europe which use high density walls/roofs as solar collectors, and of research and development work being undertaken in EEC on concrete solar collectors. The component that comprise a solar heating system integrated into a prefabricated concrete building structure are described. Feasibility of a solar/heatpump heating system integrated into a prefabricated one family dwelling of the dense, low level type was studied. Descriptions of the building and its heating system are given. Heat balance calculations private economy and energy economy calculations of the house and its alternative heating system are presented, and finally recommendations are made as to future work. DOE

N80-32940# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS OF ALUMINUM-AIR BATTERY PROPULSION SYSTEMS FOR PASSENGER VEHICLES
J. D. Salisbury and E. Behrin 1 May 1980 10 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 17-22 Aug. 1980
(Contract W-7405-eng-48)
(UCRL-83824; CONF-800806-15) Avail: NTIS HC A02/MF A01

The performance characteristics of three electric propulsion systems based on the aluminum air(AL-air) battery were analyzed and compared to the internal combustion engine (ICE). In this comparison, the engine and fuel systems of a current five passenger vehicle were conceptually replaced by three Al-air systems; (1) an Al-air battery only system; (2) an Al-air battery combined with a nickel-zinc secondary battery for power leveling; and (3) an Al-air battery combined with a flywheel power leveler. Performance characteristics such as the average consumption rate of Al metal for the selected drive cycle, vehicle mass, and power system mass were determined for each Al-air propulsion system. Estimates of initial vehicle and life cycle costs of Al-air battery only vehicles indicate that all three systems can achieve performance and operation costs comparable to an ICE vehicle, and that the initial cost of Al-air battery only vehicles can approach the cost of ICE vehicles but at reduced power levels. DOE

N80-32941# California Univ., Livermore. Lawrence Livermore Lab.
ALUMINUM AIR BATTERY FOR ELECTRIC VEHICLE PROPULSION
John F. Cooper, Robert V. Homsy, and Jerry H. Landrum 1980 10 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22, Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84443; CONF-800806-19) Avail: NTIS

HC A02/MF A01

Aluminum air battery development and the use of aluminum as a recyclable electrochemical fuel are discussed. The battery combines high specific energy (above 300 Wh/kg) and specific power (150 to 200 W/kg) with the capability of rapid refueling by addition of reactants. The objective is a commercially feasible, general purpose electric vehicle. Progress is reported in the scale up of aluminum air single cells to the automotive scale (0.1 m2 anodes) and in the development of a hydrargillite crystallizer, which is required to control electrolyte composition. The total cost and energy required to produce aluminum, and projected consumption by electric vehicles indicates that the aluminum air powered electric vehicle is potentially competitive with advanced automobiles using synthetic liquid fuels. DOE

N80-32942# Public Service Electric and Gas Co., Newark, N. J.
DISTRICT HEATING AND COOLING SYSTEMS FOR COMMUNITIES THROUGH POWER PLANT RETROFIT DISTRIBUTION NETWORK, VOLUME 4 Final Report, 1 Sep. 1978 - 31 May 1979
Oct. 1979 154 p
(Contract EM-78-C-02-4977)
(COO-4977/1-Vol-4) Avail: NTIS HC A08/MF A01

Institutional factors, legal and regulatory aspects, a preliminary economic analysis, and a proposal for future studies on retrofitting existing thermal power plants are presented. The data is utilized so that the thermal plants can supply heat for district heating and cooling systems for communities. DOE

N80-32943# Avco-Everett Research Lab., Mass.
ENGINEERING TEST FACILITY CONCEPTUAL DESIGN Final Technical Report
Feb. 1980 159 p
(Contract EF-77-C-01-2614)
(DOE/FE-2614/3) Avail: NTIS HC A08/MF A01

The power system configuration originally specified for the ETF considered the use of a high temperature air preheater, separately fired initially with oil and subsequently with a LBtu gas produced in a coal gasifier integrated with the power plant. This eliminates the need for a high temperature air preheater and its associated gasifier. The results from initial parametric design analysis in the separate study of early commercial MHD power plants reinforced the potential attractiveness of the use of oxygen enrichment of the combustion air. Preliminary analysis of the use of oxygen enrichment for ETF is also included. DOE

N80-32944# Chamberlain Mfg. Co., Waterloo, Iowa. Research and Development Div.
THE 3X COMPOUND PARABOLIC CONCENTRATING (CPC) SOLAR ENERGY COLLECTOR Final Technical Report
Robert W. Ballheim 25 Apr. 1980 207 p refs
(Contract DE-AC04-78CS-04239)
(DOE/CS-04239/T1; CMC-C8178-PR-017) Avail: NTIS HC A10/MF A01

A 3X compounds parabolic concentrating (CPC) collector was designed. The collector is a completely housed, 105.75 x 44.75 x 10.23 inch, 240 pound unit with six each evacuated receiver assemblies, a center manifold and a one piece glass cover. A truncated version of a CPC trough reflector system and the General Electric Company tubular evacuated receiver were integrated with a mass producible collector design suitable for operation at 250 to 450 F. The key criterion for optimization of the design was minimization of the cost per Btu collected annually at an operating temperature of 400 F. The reflector is a 4.1X design truncated to a total height of 8.0 inches with a resulting actual concentration ratio of 2.6 to 1. The manifold is an insulated area housing the fluid lines which connect the six receivers in series with inlet and outlet tubes extending from one side of the collector at the center. DOE

N80-32945# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEM, PHASE 1. SUBSYSTEM EXPERIMENT: RECEIVER HEAT TRANSFER
Arthur J. Slemmons Apr. 1980 125 p refs
(Contract EY-76-C-03-0115)
(DOE/ET-20550/1) Avail: NTIS HC A06/MF A01

Wind tunnel tests confirmed that heat losses due to natural convection are negligible in the line focus, solar powered receiver. Anomalies in the forced convection tests prevented definitive conclusions regarding the more important forced convection. Flow-visualization tests using a water table show much lower velocities inside the receiver cavity than outside, supporting the supposition that the forced heat transfer should be less than that from a standard exposed cylinder. Furthermore, the water table tests showed ways to decrease the low velocities in the cavity should this be desired. Further wind tunnel testing should be done to confirm estimates and to support advanced design. This testing can be done in standard wind tunnels since only the forced convection is of concern. DOE

N80-32946# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
THERMOGRAPHIC TECHNIQUES APPLIED TO SOLAR COLLECTOR SYSTEMS ANALYSIS
Anthony Eden Feb. 1980 8 p refs Presented at ASME Century 2 Emerging Energy Technol. Conf., San Francisco, 19-21 Aug. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-351-540; CONF-800804-20) Avail: NTIS HC A02/MF A01

The use of thermography to analyze large solar collector array systems under dynamic operating conditions is discussed. The research focused on thermographic techniques and equipment to determine temperature distributions, flow patterns, and air blockages in solar collectors. The results, covering many sites and types of collectors, illustrate the capabilities of infrared (IR) analysis as a qualitative analysis tool and operation and maintenance procedure when applied to large arrays. Thermographic analysis of most collector systems qualitatively showed relative temperature distributions that indicated balanced flow patterns. In three significant cases, blocked or broken collector arrays, which previously had gone undetected, were discovered. Using this analysis, validation studies of large computer codes could examine collector arrays for flow patterns or blockages that could cause disagreement between actual and predicted performance. DOE

N80-32947# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR PONDS AND THEIR APPLICATIONS
T. S. Jayadev and M. Edesess Mar. 1980 12 p refs Presented at the 7th Energy Technol. Conf. and Exposition, Washington, D.C., 25 Mar. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-733-617; CONF-800352-4) Avail: NTIS HC A02/MF A01

Solar ponds are probably the simplest and least expensive technology for conversion of solar energy to thermal energy. The solar pond is unique in its ability to act both as collector and as storage. The cost of a solar pond per unit area is considerably less than that of any active collector available today. The combination of their economic and technical factors make solar ponds attractive for district heating and industrial process heat applications. Solar ponds have the potential to displace significant quantities of fossil fuel in low-temperature heating applications in nonurban areas. DOE

N80-32948# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PERFORMANCE OF STORAGE WALLS WITH HIGHLY CONDUCTIVE COVERING PLATES AND CONNECTING FINS
Joseph K. E. Ortega, Carl E. Bingham, and J. Michael Connolly May 1980 9 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-574) Avail: NTIS HC A02/MF A01

The thermal behavior of a storage wall, constructed of concrete with highly conductive plates and connecting vertical fins, is investigated. The results demonstrate that, during the charging mode, the amount of energy released from the front surface is significantly reduced. A portion of the saved energy is stored for future discharge, but a large portion is transferred to the back surface and released. A selective front surface reduces the energy released from the front surface, and this energy is

stored. By properly selecting the fin spacing, plate-fin thickness, and plate-fin thermal conductivity, the rate and direction of thermal discharge can be controlled. The improved heat transfer capability and added thermal control provide new alternatives for interzonal heat transfer and multizone passive building designs. DOE

N80-32948# Midwest Research Inst., Golden, Colo. Passive Technology Branch.
COMPUTER MODELING OF THERMAL STORAGE WALLS
J. Michael Connolly, Carl E. Bingham, and Joseph K. E. Ortega May 1980 7 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-610) Avail: NTIS HC A02/MF A01

The modeling of the three dimensional heat transfer characteristics of thermal storage walls and the effect of nonuniform irradiation is investigated. Depending on how much of the wall is irradiated, a small error in energy storage is introduced with the one dimensional, uniform irradiation assumption. The results show that these assumptions, currently used in most passive design codes, are adequate to predict the thermal energy storage characteristics. However, the temperature distribution along the surface of the wall is much different when the nonuniform irradiation case is considered. The addition of a highly conductive metal cover on the front surface of the wall does not significantly improve the thermal energy storage characteristics of the wall when the wall is partially irradiated. A selective radiation coating reduces front losses and improves the energy storage capacity of the wall 9 to 13%. DOE

N80-32950# Massachusetts Univ., Amherst. Energy Alternatives Program.
INVESTIGATION OF THE FEASIBILITY OF USING WIND POWER FOR SPACE HEATING IN COLDER CLIMATES
Annual Report, period ending 30 Jun. 1978
D. E. Cromack Oct. 1979 116 p refs
(Contract DE-AC04-76DP-03533)
(DOE/DP-03533/T3) Avail: NTIS HC A06/MF A01

Background and progress to date for the Wind Furnace Project at the University of Massachusetts is reported. The Wind Furnace installed at Solar Habitat-1 is described. More detail is presented under the summary discussions for each task with referenced technical reports and published papers giving a full description of the specific tasks. DOE

N80-32951# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
ANALYTICAL STUDIES OF WIND TURBINE TURNING CHARACTERISTICS
A. S. Mikhail and C. G. Justus Jun. 1979 26 p refs
(Contracts DE-AS06-78ET-20355)
(RLO/2439-79/3) Avail: NTIS HC A03/MF A01

Data from 14 sites were arranged in time-series format for wind speed and direction. The sites were chosen based on the availability of hourly observations and suitability of the sites for wind energy applications. The hourly turns of the wind were summed vectorially. Monthly and annual cummulative turns at each site were computed. To simulate the performance of actual wind turbines, threshold wind speed values of 0, 1, 2, 3, 4, 5, and 6 m/s were chosen. A threshold wind speed is defined as wind speed below which the turbine is not expected to turn with the wind. DOE

N80-32952# Franklin Research Center, Philadelphia, Pa.
SELF CONTROLLING, SELF PUMPING HEAT CIRCULATION SYSTEM STUDY Final Report, 1 Aug. 1977 - 31 Jul. 1978
G. P. Wachtell 31 Jul. 1978 153 p refs
(Contracts DE-AC02-77CS-34484; EG-77-C-02-4484)
(COO-4484-07; FRC-C4772-2) Avail: NTIS HC A08/MF A01

Self pumping methods for transporting heat from roof-mounted flat plate solar collectors to thermal energy storage at a lower evaluation are described and evaluated. Power cycles are feasible for sensible heat transport with air or water, and also in latent heat transport systems. Vapor bubble life for circulating water and latent heat transport with condensate return by the vapor stream are recommended for development as devices with no moving parts. Development of an injector for circulating liquid is also recommended, although higher collector temperatures or circulants that are more volatile than water would be needed. Some methods of delivering heat to the TES using photovoltaic power or small amounts of utility power were evaluated. DOE

N80-32953# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
OXIDATION OF ELECTRODEPOSITED BLACK CHROME SELECTIVE SOLAR ABSORBER FILMS
P. H. Holloway, K. Shanker, R. B. Pettit (Sandia National Labs.), and R. R. Sowell (Sandia National Labs.) 1980 19 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21 Apr. 1980
(Contracts DE-AC04-76DP-00789; DE-FG02-79ER-10541)
(SAND-80-1045C; CONF-800439-11) Avail: NTIS HC A02/MF A01

X-ray photoelectron and Auger electron spectroscopes were used to study the composition and oxidation of electrodeposited black chrome films. The outer layer of the film is Cr203 with the inner layer being a continuously changing mixture of Cr + Cr203. Initially, approximately 40 percent by volume of the film is combined as Cr203, and the volume percentage of Cr203 increases to greater than 60 percent after only 136 hours at 250 C. After approximately 3500 hours at 400 C, the volume percentage of Cr203 increased to as high as 80 percent. The thermal emittance decreased approximately linearly with increasing oxide content, while the solar absorptance remained constant until the percentage of Cr203 exceeded approximately 70 percent. Oxidation was slower when the Cr(+3) concentration in the plating bath was reduced from 16 g/l to 8 g/l, and when black chrome was deposited on stainless steel rather than sulfamate nickel. DOE

N80-32954# Puerto Rico Office of Energy, Santurce.
CONCENTRATING PHOTOVOLTAICS FOR THE TROPICS
Final Report, 1 Jun. 1978 - 28 Feb. 1979
30 Jun. 1979 283 p refs
(Contract ET-78-C-04-4270)
(DOE/CS-04270/1) Avail: NTIS HC A13/MF A01

The design and specifications of a photovoltaic concentrator total energy system are presented. The design will provide nearly half the electrical energy needs and most of the thermal energy needs (absorption chillers) of the Center for Energy and Environment Research, University of Puerto Rico, and the hot water needs of the Oncologic Hospital and Children's Hospital, Puerto Rico Medical Center. The system will utilize 34,190 sq ft of 40X slat type concentrators with secondary CPC concentrators to provide 162 kWe. The combined photovoltaic/thermal collector system utilizes a 20,000 gal steel thermal storage tank, and two absorption refrigeration units which will produce a total of 149 tons of cooling. Detailed drawings and system fabrication and installation plans are included. Insolation data for the San Juan, Puerto Rico site are presented, and calculated system performance based on this data is presented. DOE

N80-32955# Midwest Research Inst., Golden, Colo.
MODEL OF DIRECT CONTACT HEAT TRANSFER FOR LATENT HEAT ENERGY STORAGE
Michael E. Cease May 1980 8 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TP-631-567; CONF-800806-27) Avail: NTIS HC A02/MF A01

In a direct contact heat transfer system, an immiscible fluid was bubbled through the storage media and heat was transferred between the phases as the droplets rose. An analytical model is presented for predicting the temperature of the rising droplets from information in the literature. The drop size was calculated from empirical correlations in the jetting formation region and rise velocity was characterized by a creeping-flow surface cell model which accounts for the hindering effects of neighboring droplets. The viscosity of the crystallizing solution in the rise velocity equation was approximated by an expression for concentrated suspensions, where the percentage of solids was taken as the percentage of crystallization. Dispersed phase holdup was predicted with the rise velocity. Calculation of the rate of heat transfer to the dispersed immiscible fluid droplets was based

on three different internal hydrodynamic approximations: rigid, internally circulating, and wall-mixed spheres. DOE

N80-32958# Midwest Research Inst., Golden, Colo. Technical Information Dissemination Program.

PROCEEDINGS OF THE OCEAN ENERGY INFORMATION DISSEMINATION WORKSHOP

Don Petty Solar Energy Research Inst. Apr. 1980 22 p Workshop held in Golden, Colo., 6-7 Dec. 1979

(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)

(SERI/TP-732-600) Avail: NTIS HC A02/MF A01

The workshop was held to discuss the status of marketing ocean energy information and to develop an understanding of information needs and how to satisfy them. Presentations were made by the Solar Energy Research Institute (SERI) staff and media consultants about the effective use of audio visual and print products, the mass media, and audience needs. Industry and government representatives reported on current efforts in each of their communication programs and outlined future plans. Four target audiences (DOE contractors, researchers, influencers, and general public) were discussed with respect to developing priorities for projects to enhance the commercialization of ocean energy technology. DOE

N80-32957# United Technologies Research Center, East Hartford, Conn.

DEVELOPMENT OF AN 8 kW WIND TURBINE GENERATOR FOR RESIDENTIAL TYPE APPLICATION. PHASE 1: DESIGN AND ANALYSIS. VOLUME 1: EXECUTIVE SUMMARY

M. C. Cheney et al 25 Jun. 1979 8 p

(Contract DE-AC04-76DP-03533)

(DOE/DP-03533/T1-Vol-1) Avail: NTIS HC A02/MF A01

Special features of the composite bearingless rotor, developed initially for helicopter application, were used in the design of a prototype wind turbine whose blade is comprised of an outer or aerodynamic portion fabricated from fiberglass using a pultrusion process, and an inner portion, called the flexbeam which is made up of unidirectional graphite epoxy. A rotor diameter of 9.4m was selected, producing more than the required 8 kW at 9m/s wind speeds, more typical of residential areas. Performance was calculated for two rotor speeds, representing two different gearbox step up ratios. Design studies and supporting analytical efforts show that the 8 kW prototype satisfies program objectives relative to performance and operational characteristics. Stability and loads calculations, using stabilized helicopter aeroelastic codes, demonstrate the system is well damped under all loading conditions and operates well below allowable stress levels. System costs are running about 20% higher than the contract goals; however, reductions in the main frame and tower costs appear feasible, and would be explored in a second generation 8 kW design. A.R.H.

N80-32958# Oak Ridge National Lab., Tenn. Energy Div.

APPRAISAL OF THE M FACTOR AND THE ROLE OF BUILDING THERMAL MASS IN ENERGY CONSERVATION

K. W. Childs Jul. 1980 51 p refs

(Contract W-7405-eng-26)

(ORNL/CON-46) Avail: NTIS HC A04/MF A01

A concept in heat transfer calculations known as the M factor was introduced to account for thermal storage due to mass in building walls. The assumptions behind the development of the M factor are reviewed. The effect of mass in walls on seasonal or annual energy transmission through walls is examined, as well as the applicability of the M factor as a correction to account for any mass effects. In connection with the effect of mass on seasonal energy consumption, the use of an M factor correction when checking a building for compliance with energy conservation standards is investigated. The suitability of applying the M factor correction to the peak load determined by a steady state calculation for equipment sizing is also explored. In addition, the relationship of thermal mass to other parameters that determine loads and energy consumption is investigated, and the role of thermal mass in energy conservation is discussed. DOE

N80-32959# Midwest Research Inst., Golden, Colo. Buildings Div.

POTENTIAL DISPLACEMENT OF PETROLEUM IMPORTS BY SOLAR ENERGY TECHNOLOGIES

Peter DeLeon, Byron L. Jackson, Robert F. McNown (Colorado Univ., Boulder), and Gary J. Mahrenholz (Colorado Univ., Boulder) May 1980 59 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-352-504) Avail: NTIS HC A04/MF A01

The United States currently imports close to half of its petroleum requirements. The economic, social, and political costs of a foreign oil dependency are discussed. Development of alternative, domestic energy sources, such as solar energy technologies, which can displace foreign petroleum is discussed. It is estimated that by the year 2000, solar energy technologies can displace 3.6 quads of petroleum. This figure includes solar energy applications in utilities, industrial and agricultural process heat, and transportation. The estimate can be treated as a lower bound; if the United States were to achieve the proposed goal of 20 quads by 2000, the amount of displaced oil probably would be greater. Although all the displaced oil would not be imported, the reduction in imported petroleum would relieve many of the conditions that increase the present cost of foreign oil to the American consumer. DOE

N80-32960# Oak Ridge National Lab., Tenn. Energy Div.

DEVELOPMENT OF AN ENERGY CONSUMPTION AND COST DATA BASE FOR FUEL CELL TOTAL ENERGY SYSTEMS AND CONVENTIONAL BUILDING ENERGY SYSTEMS

G. D. Pine, J. E. Christian, W. R. Mixon, and W. L. Jackson Jul. 1980 75 p refs

(Contract W-7405-eng-26)

(ORNL/CON-38) Avail: NTIS HC A04/MF A01

The procedures and data sources used to develop an energy consumption and system cost data base for use in predicting the market penetration of phosphoric acid fuel cell total energy systems in the nonindustrial building market are described. A computer program was used to simulate the hourly energy requirements of six types of buildings; office buildings; retail stores; hotels and motels; schools; hospitals; and multifamily residences. The simulations were done by using hourly weather tapes for one city in each of the ten Department of Energy administrative regions. Two types of building construction were considered, one for existing buildings and one for new buildings. A fuel cell system combined with electrically driven heat pumps and one combined with a gas boiler and an electrically driven chiller were compared with similar conventional systems. The methods of system simulation, component sizing, and system cost estimation are described for each system. DOE

N80-32961# Polytechnic Inst. of New York, Brooklyn. Solar Energy Applications Center.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT SOLAR HOT WATER INITIATIVE: CENTRALIZED COORDINATION OF TECHNICAL TASKS AND SYSTEM EVALUATION Final Report

Richard S. Thorsen, Donald F. Hunt, Wheeler K. Mueller, Anil V. Padhye, and Ellen P. Priolo Dec. 1979 414 p Sponsored in part by HUD, Washington, D.C. and N.Y. State Energy Research and Development Authority

(PB80-189244; POLY-M/AE-79-64; HUD-0001443) Avail: NTIS HC A18/MF A01 CSCL 13A

The installation of 10,867 approved solar hot water heating systems in 10 contiguous Northeastern and Middle Atlantic States and Florida by August 1978 is described. Specific problems, such as availability of standards and test laboratories, installation deficiencies, and warranty requirements, are listed as well as their solutions. GRA

N80-32962# Tata Energy Research Inst., Bombay (India). Documentation Centre.

SOLAR PASSIVE SYSTEMS FOR BUILDINGS

Mar. 1980 54 p refs

(PB80-187719) Avail: NTIS HC A04/MF A01 CSCL 13A

A survey is provided of what is known about the design of solar passive buildings. A systematic presentation is given of proven concepts with suitable illustrations. It is intended as a general guide for architects, designers and other building practitioners. Topics include the various concepts of solar passive

heating and cooling, design factors such as location, climate, microclimate, form; building metabolism, thermal and visual comfort; location and form of illumination; and natural cooling via wind towers and cisterns. GRA

N80-32963# California Energy Commission, Sacramento.
ENVIRONMENTAL IMPLICATIONS OF ELECTRIC UTILITY SUPPLY PLANS, 1978-2000 Final Report
Tom MacDonald May 1980 109 p refs
(PB80-192156; CAEC-64; CAEC-300-80-005) Avail: NTIS HC A06/MF A01 CSCL 10B

The results of the environmental assessment of the current electricity supply plans of the California utilities are presented. Major areas of assessment were construction and operation of electric generation facilities, including air quality, land use, and solid waste disposal. Maps show the locations of utility proposed generation facilities and potential siting areas for additional facilities. Methods used to designate potential siting areas based on a statewide siting assessment are discussed. GRA

N80-32964# Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Services Program.
PROCEEDINGS OF THE CLEMSON WORKSHOP ON ENVIRONMENTAL IMPACTS OF PUMPED STORAGE HYDROELECTRIC OPERATIONS
James P. Clugston, ed. Apr. 1980 214 p refs Workshop held in Clemson, S. C., 15-16 May 1979
(PB80-192453; FWS/OBS-80/28) Avail: NTIS HC A10/MF A01 CSCL 10B

The pumping of water to a high reservoir for storage during periods of low power demand, so that it can be used for the generation of electricity during peak power demand was discussed. Papers which were presented exchanged ideas and data with regard to the environmental impact of this regular interchange of water. L.F.M.

N80-32965*# New Mexico Univ., Albuquerque. Technology Application Center.
FORECASTS OF ENERGY TECHNOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Dec. 1979
Mary K. Gallagher Jul. 1980 60 p Supersedes NTIS/PS-79/0337 Sponsored in cooperation with NASA and NTIS
(NASA-CR-163596; PB80-812324; NTIS/PS-79/0337) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Approximately 183 citations on the development of energy technology are presented. Emphasis is placed on forecasts relating to new energy sources such as hydrogen-based energy, solar energy conversion and to nuclear energy and coal utilization. Economic analyses of various energy conversion techniques are included. GRA

N80-32966# National Technical Information Service, Springfield, Va.
NICKEL CADMIUM BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 141 p Supersedes NTIS/PS-79/0647 and NTIS/PS-78/0618
(PB80-812340; NTIS/PS-79/0647; NTIS/PS-78/0618) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

The design, fabrication, components, testing, and assembly of nickel cadmium batteries are covered in the bibliography. The majority of these citations deal with the development of power supplies for aircraft and spacecraft. This updated bibliography contains 135 abstracts, 19 of which are new entries to the previous edition. GRA

N80-32967# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 162 p refs Supersedes NTIS/PS-79/0675; NTIS/PS-79/0660
(PB80-812399; NTIS/PS-79/0675; NTIS/PS-78/0660) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Federally funded research on design, development, components, testing corrosion, electrolytes, sealing, hazards of lithium cells are presented. Batteries studied include lithium organic cells, lithium sulfur cells, lithium water air cells, and lithium nickel fluoride cells. Applications cover use in spacecraft, electric vehicles, off peak energy storage, and forklift trucks. This updated bibliography contains 151 citations, 57 of which are new entries to the previous edition. GRA

N80-32968# National Technical Information Service, Springfield, Va.
LITHIUM BATTERIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 290 p Supersedes NTIS/PS-79/0676; NTIS/PS-78/0661
(PB80-812407; NTIS/PS-79/0676; NTIS/PS-78/0661) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Studies on design, development, components, corrosion, and hazards are included in the compilation of worldwide research. Lithium batteries with sulfides, chlorine, thionyl chloride, organic compounds, and water are cited. Applications cover use of lithium cells in pacemakers, spacecraft, electric vehicles, and off peak energy storage. This updated bibliography contains 283 citations, 60 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-32969# California Univ., Riverside.
THE EFFECT OF DESIGNATED POLLUTANTS ON PLANT SPECIES Annual Report, 1 Jul. 1978 - 30 Jun. 1979
A. L. Granett and O. C. Taylor Dec. 1979 64 p refs
(Contract F33615-76-C-5005)
(AD-A078933; AMRL-TR-79-73; AR-4) Avail: NTIS HC A04/MF A01 CSCL 13/2

The phototoxicity of hydrogen chloride (HCl) gas was studied with particular emphasis on various external plant stresses. Greenhouse grown plants and indoor exposure chambers were utilized to test the effect of viral infection, insecticide treatment, weed killer applications, or antioxidant protectants on injury caused by HCl gas. Plant sensitivity did not differ between virus infected and non viral plants. Increased injury, however, was seen on plants exposed to HCl gas after one of the insecticide treatments. An experimental antioxidant compound which protects plants from ozone injury did not increase tolerance to HCl gas. Some plants were fumigated only once while others received weekly doses. Field plants were generally more tolerant than the same species grown in the greenhouse. HCl for the field work was generated either by diluting pressurized dry gas in a large volume of flowing carrier gas or by open burning of small pieces of solid rocket fuel. Portable chambers remained over the field plants only for the duration of the 15 minute exposures. T.M.

N80-32970*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0014
Daniel Briehl, Thomas J. Dudzinski, and David C. Liu Washington Sep. 1980 43 p refs
(NASA-TM-81579; E-549) Avail: NTIS HC A03/MF A01 CSCL 13B

The data currently available from GASP, including flight routes and dates, instrumentation, data processing procedures, and data tape specifications are described. Measurements of atmospheric ozone, cabin ozine, carbon monoxide, water vapor, particles, clouds, condensation nuclei, filter samples and related meteorological and flight information obtained during 562 flights of aircraft N533PA, N4711U, N855PA, and VH-EBE from October 3, 1977 through January 5, 1978 are reported. Data representing tropopause pressures obtained from time and space interpolation of National Meteorological Center archived data for the dates of the flights are included. R.K.G.

N80-32971# Environmental Protection Agency, Leonardo, N.J. Ohmsett Test Facility.

PERFORMANCE TESTS OF HIGH SPEED ZRV OIL SKIMMER Final Report, 8 Sep. - 13 Oct. 1979

Michael K. Breslin (Mason and Hanger-Silas Mason Co., Inc.) Jun. 1980 156 p refs

(Contract DOT-CG-842702-A)

(AD-A088062; USCG-D-42-80) Avail: NTIS HC A08/MF A01 CSCL 13/11

A self-propelled catamaran oil skimmer developed by the USCG capable of recovering oil from a water's surface was tested at the U.S. EPA OHMSETT facility. The skimmer employed an endless composite sorbent belt processed between the catamaran hulls to recover oil. The tests were designed to determine the effect that various parameters (skimmer speed, oil viscosity, oil thickness, wave conditions, etc.) have upon oil recovery performance. The skimmer was towed through oil slicks at various speeds in different wave conditions as it was operated to collect oil. The collected fluid was quantitatively analyzed to determine the device's oil-to-water recovery ratio (recovery efficiency), oil recovery rate and thoroughness of slick removal (throughput efficiency). The device proved capable of good throughput efficiency in all wave conditions (up to 0.7 m confused seas) at all the tow speeds tested (1 to 6 knots). Throughput efficiencies of 80 to 90% in calm water were common with all the oils tested. The performance of the full-scale skimmer agreed well with the results from the smaller prototype tested in 1976. The successful development of this skimmer provides a significant advance in oil spill recovery capability and technology. The concept used in this oil skimmer can be employed at speeds greater than those tested. Two oil slick converging systems were tested with the skimmer to effectively double the sweep width of the skimmer. Additional tests were conducted to determine vessel resistance and motion in waves and to assess the buildup of potentially explosive vapors within the oil recovery system. GRA

N80-32972# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.

ENVIRONMENTAL CONTROL TECHNOLOGY FOR CARBON DIOXIDE Final Report

Anthony S. Albanese and Meyer Steinberg May 1980 30 p refs

(Contract DE-AC02-76CH-00016)

(DOE/EV-0079) Avail: NTIS HC A03/MF A01

The impact of fossil fuel use in the US on worldwide CO2 emissions and the impact of increased coal utilization on CO2 emission rates are assessed. The aspects of CO2 control are discussed as well as the available CO2 removal sites. The primary factor affecting the practicability of a CO2 control system is its energy requirements. At a CO2 removal efficiency of 50%, the power generation efficiency of a conventional coal fired power plant would be reduced from 34% to about 25%, and the cost of power generation would be expected to double. For 90% CO2 removal, power generation efficiency is reduced to between 15 and 6% and the cost of power generation increases by a factor of from 4 to 7. DOE

N80-32973# Los Alamos Scientific Lab., N. Mex.

ASSESSMENT OF ENVIRONMENTAL CONTROL TECHNOLOGIES FOR ENERGY STORAGE SYSTEMS, 1979

M. C. Krupka, J. E. Moore, W. E. Keller, G. A. Baca, R. I. Brasier, and W. S. Bennett Apr. 1980 123 p refs

(Contract W-7405-eng-36)

(LA-8308-MS) Avail: NTIS HC A06/MF A01

Environmental impacts are identified, control techniques are described and recommendations for needed control technology are made. The storage technologies investigated include: lead acid battery, hydroelectric pumped, superconducting magnet, compressed air, flywheel and thermal. Environmental impacts of fuel cell technology is also presented. Although not strictly energy storage devices, many of the benefits attributed to fuel cells are similar to those of the other storage systems. In addition, sections on new applications for energy storage technologies and the additional costs of controls to be used for mitigation of certain adverse impacts are also presented. Detailed discussion of the various environmental impacts as they relate to primarily operational situations are emphasized. DOE

N80-32974# Stuttgart Univ. (West Germany). Inst. fur Kernenergetik und Energiesysteme.

SIMULATION OF THE ENERGY-INDUSTRY-ENVIRONMENT SYSTEM FOR LIMITED ECONOMIC REGIONS, USING THE EXAMPLE OF BADEN-WUERTTEMBERG. PART 1: DATA. MODEL DEVELOPMENT ADAPTATION Progress Report, 1980 - 1974 [SIMULATION DES SYSTEMS ENERGIE-WIRTSCHAFT-UMWELT FUR BEGRENZTE WITSCHAFTSRAUME AM BEISPIEL BADEN-WURTTEMBERGS ZUSAMMENFASSENDER SCHLUSSBERICHT]

K. H. Hoecker and H. Unger Oct. 1979 105 p refs In GERMAN

(IKE-K-54-20-Pt-1) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

The structure and development of the Baden-Wuerttemberg power industry is analyzed and these data are compared with the data for West Germany. On the producer side, there are especially the electric power industry and the petroleum industry; on the consumer side, there are the usual sectors of private households and small consumers, industry, and transportation. The development of the past power supply structure is analyzed, and the analysis is used as a basis for a forecast. The model structure and methods are described. DOE

N80-32975# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ECOSYSTEM THEORY AND THE UNEXPECTED: IMPLICATIONS FOR ENVIRONMENTAL TOXICOLOGY

R. V. ONeill and J. B. Waide 1980 42 p refs Presented at the Toxic Substances in the Environ., Batelle Columbus, Ohio, Mar. 1980

(Contract W-7405-eng-26; Grant NSF DEB-77-25781)

(CONF-800376-1) Avail: NTIS HC A03/MF A01

The necessity of considering in research, the components of ecosystems as parts of the dynamic whole is emphasized. In the first section the notion of the system as it emerges from hierarchy theory is developed. The next section emphasizes the ecosystem as a biogeochemical system. The focus is also placed explicity on the system component problem, and ecological exmples of problems involved in extrapolating from component measurements to system behaviors are given. Recommendations for toxic substances research are included. DOE

N80-32976# Aerodyne Research, Inc., Bedford, Mass. Center for Chemical and Environmental Physics.

HOMOGENEOUS PRODUCTION AND REMOVAL OF NO/SUBx/ FROM COMBUSTION EXHAUST GASES Quarterly Technical Summary Report, 1 Mar. - 31 May 1980

J. A. Silver, C. M. Gozewski, and C. E. Kolb Jun. 1980 22 p refs

(Contract ER-78-C-01-3183)

(ARI-RP-55; QTSR-7) Avail: NTIS HC A02/MF A01

The rate constants for the reaction OH + NH3 yields NH2 + H2O were measured over the temperature range 294 to 1075 K. The data are fitted by the Arrhenius expression k(cc/molecule/s)= 5.41 + or - 0.86 x 10 to the minus 12th power expl-2120 + or - 143 kcal/mole/RT). A chemical model of the NOx chemistry was developed which includes 54 reactions. Although not yet complete, the reaction set clearly indicates the key reaction is NH2 + NO. The determination of the product channels and their branching ratios is of utmost importance in understanding the effect of NH3 addition to combustor exhaust streams for removal of NOx. DOE

N80-32977# Sandia Labs., Albuquerque, N. Mex.

METEOROLOGICAL AND AIR QUALITY DATA REPORT, WIPP SITE: EDDY COUNTY, NEW MEXICO Spring Quarter Report, Mar. - May 1977

L. P. Pocalujka, E. Babij, P. A. Catizone, and H. W. Church Mar. 1980 244 p refs Prepared in cooperation with TRC Environmental Consultants, Inc., Wethersfield, Conn.

(Contract DE-AC04-76DP-00789)

(SAND-79-7109) Avail: NTIS HC A11/MF A01

Site suitability of the Waste Isolation Pilot Plant (WIPP) is supported by meteorological, air quality, and radiological measurements. DOE

N80-32978# Department of Energy, New York. Environmental Studies Div.

ENVIRONMENTAL MEASUREMENTS LABORATORY
Environmental Quarterly, 1 Mar. - 1 Jun. 1980
Edward P. Hardy, Jr. 1 Jul. 1980 69 p refs
(EML-374) Avail: NTIS HC A04/MF A01

Interpretive reports and notes dealing with strontium-90 in human bone from Bombay, chemical composition of the aerosol at American Samoa, and strontium-90 in New York and San Francisco diets are presented. Tabulations of strontium-90 fallout, chemical constituents of wet and dry deposition, radionuclide and trace metal concentrations in surface air, and strontium-90 concentrations in human bone, milk and tap water are included. A bibliography of publications related to environmental studies is also presented. DOE

N80-32979# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
MICROCOSMS AS POTENTIAL SCREENING TOOLS FOR EVALUATING TRANSPORT AND EFFECTS OF TOXIC SUBSTANCES
B. S. Ausmus, G. K. Eddlemon, S. J. Draggan, J. M. Giddings, D. R. Jackson, R. J. Luxmoore, E. G. ONeill, R. V. ONeill, Monte Ross-Todd, and P. VanVoris Jun. 1980 404 p refs Prepared in cooperation with ORNL
(Contract W-7405-eng-26)
(ORNL/EPA-4; EPA-600/3-80-042; Publ-1506) Avail: NTIS HC A18/MF A01

Terrestrial and aquatic microcosms were evaluated for use in research on environmental contaminants. A number of experimental approaches using several microcosm designs and contaminants are reported. The use of terrestrial microcosm results was evaluated in conjunction with mathematical simulation models as a means of extending short term experimental results to interpret conditions as they might occur in the natural ecosystem. Although microcosms offer an excellent experimental system, their application to toxic substance testing is not a straightforward matter. They are characterized by complex dynamics and counterintuitive responses just as is the ecosystem to which they are an analog. These factors notwithstanding, microcosms do offer an excellent means of studying specific aspects of contaminant behavior and ecosystem processes. DOE

N80-32980# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SENSITIVITY OF THE EASTERN UNITED STATES TO ACID PRECIPITATION IMPACTS ON SURFACE WATERS
George R. Hendrey, James N. Galloway (Virginia Univ.), Stephen A. Norton (Maine Univ., Orono), and Carl L. Schofield (Cornell Univ.) Mar. 1980 7 p refs Presented at the Intern. Conf. on the Ecol. Impact of Acid Precipitation, Sandefjord, Norway, 11-14 Mar. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27851; CONF-800365-3) Avail: NTIS HC A02/MF A01

Efforts to identify areas of the United States where soils and freshwaters might be sensitive to acidification proceeded from analyses of large scale geologic maps. These are useful in a general way but a finer scale analysis was needed. Such an analysis for the eastern United States was carried out, based primarily on geologic maps of scales 1:250,000 to 1:500,000. Other workers have prepared maps on a similar scale of the soils to a depth of 25 cm, and it is anticipated that both sets of maps will be merged into a combined analysis of sensitivity. Other factors important in controlling acidification of soils and freshwaters include hydrologic characteristics of the terrain, such as: soil porosity or permeability; water residence time in soil; temporal variation in precipitation rate, chemistry and volume; regional temperature patterns; and topography. DOE

N80-32981# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
MODELING THE ROLE OF TERRESTRIAL ECOSYSTEMS IN THE GLOBAL CARBON CYCLE
William E. Emanuel, Wilfred M. Post, and Herman H. Shugart, Jr. 1980 16 p refs Presented at the 11th Ann. Modeling and Simulation Conf., Pittsburgh, 1 May 1980
(Contract W-7405-eng-26; Grant NSF DEB-77-26722)
(CONF-800549-3) Avail: NTIS HC A02/MF A01

A model for the global biogeochemical cycle of carbon which includes a five compartment submodel for circulation in terrestrial ecosystems of the world is presented. Although this terrestrial submodel divides carbon into compartments with more functional detail than previous models, the variability in carbon dynamics among ecosystem types and in different climatic zones is not adequately treated. A model construct which specifically treats this variability by modeling the distribution of ecosystem types as a function of climate on a 0.5 deg latitude by 0.5 deg longitude scale of resolution is proposed. DOE

N80-32982# Sandia Labs., Albuquerque, N. Mex. Health Physics Div.
SANDIA NATIONAL LABORATORIES 1979 ENVIRONMENTAL MONITORING REPORT
Theodore N. Simmons Apr. 1980 28 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0342) Avail: NTIS HC A03/MF A01

Sandia National Laboratories in Albuquerque is located south of the city on two broad mesas. The local climate is arid continental. Radionuclides are released from five technical areas from the laboratories' research activities. The environmental monitoring program searches for cesium (137), tritium, uranium, alpha emitters, and beta emitters in water, soil, air, and vegetation. No activity was found in public areas in excess of local background in 1979. The Albuquerque population receives only 0.076 person-rem (estimated) from airborne radioactive releases. While national security research is the laboratories' major responsibility, energy research is a major area of activity. Both these research areas cause radioactive releases. DOE

N80-32983# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
CONSTRAINTS ON CARBON DIOXIDE PRODUCTION FROM FOSSIL FUEL USE
Ralph M. Rotty and Gregg Marland May 1980 37 p refs
(Contract DE-AC05-76OR-00033)
(ORAU/IEA-80-9(M)) Avail: NTIS HC A03/MF A01

The exponential growth of fossil fuel use over recent decades has resulted in a 4.3% annual increase in the carbon dioxide emitted to the atmosphere. Three types of possible constraints to limit the use of fossil fuels and the subsequent production of CO2 are discussed: resource contraints; fuel demand constraints; and environmental constraints. An analysis of the next 50 years suggests that resource constraints will not provide severe limits. Fuel demand constraints will probably limit the use of fossil fuels to levels that keep the atmospheric carbon dioxide concentration below 450 ppM(v) for the next 50 years, so that the impacts of atmospheric carbon dioxide will not cause mankind to take action soon. In spite of this conclusion a continuing, long term problem is foreseen and full efforts to understand and continually monitor the CO2 problem should be made and alertness to any changes that may require action should be maintained. DOE

N80-32984# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
OCCUPANT-GENERATED CO2 AS AN INDICATOR OF VENTILATION RATE
Isaac Turiel and John Rudy Apr. 1980 24 p refs
(Contract W-7405-eng-48)
(LBL-10496; EEB-Vent-80-15) Avail: NTIS HC A02/MF A01

In a San Francisco office building, occupant-generated CO2 was used as an indicator of the actual ventilation rate. Two techniques were employed, a decay method and an integral method and, in both cases, measurements were conducted simultaneously at several locations. The decay method compared favorably with the conventional measurement methods in both the all-outside-air and recirculation modes, whereas the integral method showed a considerable deviation from the other methods in the recirculation mode. Both techniques show promise of being suitable methods for measuring ventilation rate in commercial or institutional buildings. DOE

N80-32985# Tulane Univ., New Orleans, La. Dept. of Environmental Health Sciences.
PERFORMANCE EVALUATION OF THE AERATED LAGOON SYSTEM AT NORTH GULFORT, MISSISSIPPI Final Report, 1 Aug. 1975 - 31 Jul. 1977

Andrew J. Englande, Jr. Mar. 1980 266 p
(Grant EPA-R-803899)
(PB80-187461; EPA-600/2-80-006) Avail: NTIS HC A12/MF A01 CSCL 13B

Results indicate that the treatment system did not exceed the federal biochemical oxygen demand average monthly requirement of 30 mg/l nor the seven consecutive day limit of 45 mg/l. The stringent permit level of 15 mg/l set by the Mississippi Air and Water Pollution Control Commission, however, was exceeded in all cases. A yearly average of 30.7 mg/l of Total Suspended Solids was recorded. The system never exceeded federal or state pH criteria. Fecal coliform standards of 200 colonies/100 ml were met only during the months of January and February. Non compliance was due to low residual chlorine levels resulting from poor design and operational control. Other parameters were monitored, summarized, and discussed. GRA

N80-32986# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK

May 1980 220 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/05) Avail: NTIS HC A10/MF A01

The National Solar Data Program established solar energy systems in residential and commercial buildings across the United States. These solar sites are linked to a computer in the National Solar Data Network (NSDN). Data from this network are collected and analyzed to determine the thermal performance of each of the solar systems. The network consists of:(1) sensors which measure key performance parameters at a selected site; (2) a Site Data Acquisition Subsystem (SDAS); (3) telephone transmission circuits; and (4) a Central Data Processing System (CDES). Sensor data are collected and stored on a cassette tape in the SDAS. For the majority of parameters, raw data are collected approximately every five minutes. Solar insolation and certain other parameters, which are subject to rapid variance, are sampled every 32 seconds. Environmental information collected at the sites for the reporting month are presented. The data include: insolation, temperatures, wind, and humidity. DOE

N80-32987# Systems Science and Software, San Diego, Calif. Energy Analaysis and Environmental Div.

ORGANIC MATERIAL EMISSIONS FROM HOLDING PONDS AT COAL-FIRED POWER GENERATION FACILITIES Final Report

A. E. Rosecrance and B. N. Colby Mar. 1980 80 p refs
(EPRI-EA-1377; TPS-78-826) Avail: NTIS HC A05/MF A01

A literature survey of organic chemical emissions from holding or ash ponds which are used by most coal fired utilities to collect process waste materials was conducted. Approximately 140 Kg/day of organic material is predicted to be present in surface runoff of a hypothetical 1000 MW facility of which only 3.5 Kg/day or 2.6% of the total, is accounted for by specific compounds. Of the compounds identified, only phenol is near a level (97 microngram/1) of potential environmental significance. A survey of known holding pond influents was undertaken to assess which processes were most likely to be associated with the organic chemical content of the pond. Of the process wastes directed into the pond, cooling tower blowdown, water treatment wastes and boiler blowdown are identified as the major contributors of organic material. Organic chemical additives, which are used to control bacterial buildup, scale formation, pitting, corrosion, pH stability, and solid dispersion, account for approximately 96% of the organic pond influents. DOE

N80-32988# Department of Energy, Washington, D. C. Office of Buildings and Community Systems.

ENVIRONMENTAL ASSESSMENT. ENERGY EFFICIENCY STANDARDS FOR CONSUMER PRODUCTS Technical Support Document

Jun. 1980 137 p refs
(DOE/CS-0168; TSD-2) Avail: NTIS HC A07/MF A01

The Consumer Products Efficiency Standards (CPES) program covers: refrigerators and refrigerator-freezers, freezers, clothes dryers, water heaters, room air conditioners, home heating equipment, kitchen ranges and ovens, central air conditioners (cooling and heat pumps), furnaces, dishwashers, television sets, clothes washers, and humidifiers and dehumidifiers. DOE proposed standards for eight of the products covered by the Program in a Notice of Proposed Rulemaking. DOE expects to propose standards for home heating equipment, central air conditioners (heat pumps only), dishwashers, television sets, clothes washers, and humidifiers and dehumidifiers in 1981. No significant adverse environmental or socioeconomic impacts were found to result from instituting the CPES. DOE

N80-32989# Department of Energy, Washington, D. C. Div. of Environmental Control.

ENVIRONMENTAL-CONTROL-TECHNOLOGY ACTIVITIES OF THE DEPARTMENT OF ENERGY IN FY 1979

Jun. 1980 99 p refs
(DOE/EV-0084) Avail: NTIS HC A05/MF A01

Background material that contributes to the capability to evaluate and assess the environmental control accomplishments, issues, gaps, and overlaps associated with energy development within DOE, in conjunction with other agencies, and in the private sector is presented. A measure of the change in emphasis in the environmental control technology activities within DOE is also presented, indicating shifts, if any, in funding levels for each of the energy technologies. Total DOE FY 1979 budget outlay allocated to environmental control activities was $421,533,000 or 5.0% of the total FY 1979 DOE budget. The inputs received from the energy technology areas are summarized. These inputs were submitted in accordance with a description of environmental control related activities, which are those activities directed at research, development, and demonstration of processes, procedures, systems, subsystems, and strategies that directly or indirectly eliminate, minimize, or mitigate environmental impacts. DOE

N80-32990# KVB, Inc., Irvine, Calif. Research and Analysis Div.

INVENTORY OF EMISSIONS FROM NON-AUTOMOTIVE VEHICULAR SOURCES Final Report

H. J. Taback, J. F. Macko, N. R. Parker, D. A. Dale, and S. Erlich Feb. 1980 224 p refs
(Contract ARB-A7-167-30)
(PB80-182942; KVB-13-5808-1215; ARB-80/109) Avail: NTIS HC A10/MF A01 CSCL 13B

Methodologies for the inventory of emissions from nonautomotive vehicular sources are presented which are applicable in all areas of California. An inventory is compiled consisting of emissions for 1977 for the four counties comprising the South Coast Air Basin. Nonautomotive vehicular sources are defined as construction equipment, farm vehicles, industrial vehicles, and small boats. The general approach is to determine total annual fuel consumption by vehicle type, then multiply each total by the appropriate EPA emission factors. GRA

N80-32991# Performance Development Inst., Washington, D.C.

INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP (EXPERIMENTAL TECHNOLOGY INCENTIVES PROGRAM) POLICY RESEARCH SERIES. VOLUME 2. MARKET MECHANISMS FOR EMISSION REGULATION AND ENFORCEMENT OF EMISSION LIMITS: DETERRENCE AND DEMAND

William H. Foskett May 1980 32 p refs
(PB80-186083; NBS-GCR-ETIP-80-87-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 13B

Both trading and direct pricing types of market mechanisms for stationary source emission reduction are discussed. Even enforcement of individual source emission limits and the degree to which the private sector will organize and invest in the research and development work underlying technological innovation in air pollution control are included. Present enforcement inconsistencies, such as those among regional offices, and remedial actions are noted. If an EPA effort to strengthen detection of violations can be successfully implemented, its effect on a regulatee's perceived probability of getting caught could contribute to market participation. If the probability of detection and penalty is high, purchase of emission reductions on the market may be a more appealing alternative to regulatees than evasion or litigation. GRA

N80-32992# CSI Resource Systems, Inc., Boston, Mass.
ECONOMIC IMPACT OF SULFUR DIOXIDE AND PARTICULATE MATTER REGULATIONS IN ILLINOIS Final Report
Alan S. Cohen Oct. 1979 133 p refs Sponsored by Illinois Inst. of Natural Resources
(PB80-182645; IINR-79/22; R77-15) Avail: NTIS HC A07/MF A01 CSCL 13B

This document outlines the procedures used in preparing a benefit/cost analysis of the sulfur dioxide and particulate matter regulations listed below and describes the results indicated by the analysis. Reevaluation of rules 204 (c) (1) (A) and 203 (g) (1); deletion of rule 204 (c) (1) (D) previously designated 204 (c) (1) (B) (iii); proposal by Ashland Chemical Company to amend rule 204 (c) (1) (A); and proposal by the City of Rochelle to amend rule 203 (g) (1). The purpose of the study is to satisfy the economic impact statement requirements of Illinois Public Act 79-790. Also the report can be viewed as four separate economic impact statements. Each economic impact statement consists of sections 1,2, and the appropriate subsection of section 3. Readers only intersted in a subset of the regulations analyzed will find the documentation of each regulation self sufficient. DOE

N80-32993# Wisconsin Univ. - Madison. Water Chemistry Lab.
AVAILABILITY OF POLLUTANTS ASSOCIATED WITH SUSPENDED OR SETTLED RIVER SEDIMENTS WHICH GAIN ACCESS TO THE GREAT LAKES Final Report, 1977 - 1978
D. E. Armstrong, J. J. Perry, and D. E. Flatness Dec. 1979 102 p refs
(Contract EPA-88-01-4479)
(PB80-189566; EPA-905/4-79-028) Avail: NTIS HC A06/MF A01 CSCL 08H

The availability of certain elements, mainly phosphorus, transported to the Great Lakes by suspended sediment was evaluated. Nitrogen was also investigated because of its importance as a nutrient element; also included were certain trace metals because of concern over their possible adverse effects in the Great Lakes. GRA

N80-32994# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SAMPLING AND ANALYSIS OF REDUCED AND OXIDIZED SPECIES IN PROCESS STREAMS Final Report, Jul. 1976 - Aug. 1979
R. F. Maddalone, L. L. Scinto, and M. M. Yamada Nov. 1979 229 p refs
(Contract EPA-68-02-2165)
(PB80-191281; EPA-600/2-79-201) Avail: NTIS HC A11/MF A01 CSCL 07D

Results of a program of over 60 tasks involving the evaluation, development, testing, and field adaptation of measurement techniques for elemental analysis and inorganic compound identification in process and effluent streams are given. Procedure for particulate sampling at the inlet and outlet of FGD systems were developed. Methods for H2SO4 sampling in flue gas streams were developed based on the controlled condensation of H2SO4 vapor. Two procedure manuals were written for reduced and oxidized inorganic species. The procedures developed showed that the analysis scheme is applicable to most solid samples from combustion sources. Ion chromatographic procedures were also developed for analyzing FGD system slurry streams. GRA

N80-32995# Radian Corp., Austin, Tex.
ENVIRONMENTAL ASSESSMENT REPORT: WELLMAN-GALUSHA LOW-BTU GASIFICATION SYSTEMS Final Report, May 1978 - Sep. 1979
Pat Murin, Theresa Sipes, and G. C. Page May 1980 309 p refs
(Contract EPA-68-02-2147)
(PB80-190796; EPA-600/7-80-093) Avail: NTIS HC A14/MF A01 CSCL 07A

An overview of Wellman-Galusha gasification systems, including estimates of the systems' energy conversion efficiencies and capital and operating costs is given. It provides data characterizing the systems' input materials, process streams, products, byproducts, and multimedia discharges. It identifies pollution control alternatives for the multimedia discharges and toxic substances in the systems' products and byproducts, and estimates their costs and energy impacts. It assesses regulatory requirements for the environmental impacts of the systems. It gives data needs and recommendations for obtaining those data. GRA

N80-32996# Michigan State Univ., East Lansing. Inst. of Water Research.
THE OCCURRENCE AND BEHAVIOR OF HALOMETHANES IN THE AQUATIC ENVIRONMENT Project Completion Report, 1 Oct. 1978 - 30 Jun. 1980
Frank M. Ditri and Swiatoslav W. Kaczmar Apr. 1980 134 p refs
(Contract DI-14-34-0001-9024)
(PB80-190317; WB0-05407; OWRT-A-100-MICH(1)) Avail: NTIS HC A07/MF A01 CSCL 07D

The Red Cedar River was sampled and analyzed for halomethanes produced during the chlorination of wastewater that was discharged into the river. The development of a sewage tracer was investigated to provide a means to differentiate changes in haloform levels in the river due to dilution from those occurring as a result of volatization or adsorption. The methods researched were neutron activation analysis of europium, dysprosium and bromine, as well as a fluoresence and chloride ion tracer. The neutron activation methods were the most sensitive. Laboratory controlled haloform/oxygen gas transfer and adsorption experiments were conducted to predict the persistence of haloforms in a river system. Oxygen to haloform gas transfer ratios and a measured log sediment water partition coefficient were used to calculate Red Cedar River haloform volatization half lives. GRA

N80-32997# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Agronomy.
SORPTION PROPERTIES OF SEDIMENTS AND ENERGY-RELATED POLLUTANTS Final Report, Jul. 1977 - Dec. 1979
John J. Hassett, Jay C. Means, Wayne L. Banwart, and Susanne G. Wood Apr. 1980 50 p refs Prepared in cooperation with Maryland Univ., Solomons
(Contract EPA-68-03-2555)
(PB80-189574; EPA-600/3-80-041) Avail: NTIS HC A03/MF A01 CSCL 07D

The factors that determine the extent of sorption of organic compounds that are representative of coal conversion waste streams are described. The compounds, all radiolabeled, were acetophenone; 1-naphthol; pyrene; 7,12-dimethylbenz(a) anthracene; 3-methylcholanthrene; dibenz(a,h)anthracene; acridine; 2,2'-biquinoline; 13H-dibenzo(a,i)carbazole; dibenzothiophene; benzidine; 2-aminoanthracene; 6-aminochrysene; and anthracene-9-carboxylic acid. Batch equilibrium isotherms were determined for each compound on 14 sediments and soils that had been collected from the Missouri, Illinois, Mississippi, and Ohio rivers and their watersheds. Laboratory procedures for determining octanol water partition coefficients and water solubilities were developed and then performed on the compounds. The sorption constants were correlated with soil and sediment properties and with the water solubilities and octanol water partition coefficients of the compounds. GRA

N80-32998# Great Lakes Basin Commission, Ann Arbor, Mich.
PHOSPHOROUS CONTROL STRATEGIES AT MUNICIPAL WASTEWATER TREATMENT PLANTS IN THE US GREAT LAKES BASIN Final Report
Timothy J. Monteith, RoseAnn C. Sullivan, and William C. Sonzogni Feb. 1980 43 p refs Sponsored in part by Water Resources Council
(PB80-191059; GLBC/GLEPS-14) Avail: NTIS CSCL 08H

The current status of municipal phosphorus (P) control programs in the Great Lakes basin is documented. Thus, state policy on reducing P from municipal wastewater treatment plants within the Great Lakes basin and the present rate of compliance with this policy was examined. Information on the current technologies presently in use for controlling P at municipal wastewater treatment plants was also compiled. Finally, reduction in municipal P loads to surface water are presented. GRA

N80-32999# Exxon Research and Engineering Co., Linden, N.J.
MINIPLANT AND BENCH STUDIES OF PRESSURIZED FLUIDIZED-BED COAL COMBUSTION Final Report, Aug. 1977 - Aug. 1979
R. C. Hoke, E. S. Matulevicius, M. Ernst, J. L. Goodwin, A. R. Garabrant, I. B. Radovsky, A. S. Lescarret, R. R. Bertrand, L. A. Ruth, and V. J. Siminski Jan. 1980 333 p refs
(Contract EPA-68-02-1312)
(PB80-188121; EXXON/GRU.18GFGS.79; EPA-600/7-80-013) Avail: NTIS HC A15/MF A01 CSCL 07A

Results of studies on the environmental aspects of the pressurized fluidized-bed coal combustion process are given. The process uses kg coal/hr continuous combustion sorbent regeneration Miniplant (0.63 MW equivalent), and a 13 kg coal/hr bench-scale system. GRA

N80-33000# Virginia Univ., Charlottesville. Dept. of Chemical Engineering.
SULFUR DIOXIDE OXIDATION IN SCRUBBER SYSTEMS Final Report, Jul. 1977 - Jun. 1979
J. L. Hudson Apr. 1980 257 p refs
(Contract EPA-R-805227)
(PB80-187842; EPA-600/7-80-083) Avail: NTIS HC A12/MF A01 CSCL 07D

The liquid phase oxidation kinetics of bisulfite and sulfite anions (determined in bench scale experiments) to conditions representative of limestone scrubbers used for the flue gas desulfurization is detailed. The chemical reaction rates were determined for clear solutions and slurries of calcium sulfite when gas to liquid transfer of oxygen was not a limiting resistance. A mathematical model was developed for the overall oxidation rate of calcium sulfite slurries, including solids dissolution and chemical reaction. The overall rate is shown to decline with increasing pH. The homogeneous chemical oxidation rate is 1.5 order and increases with pH. GRA

N80-33001# Martin Marietta Corp., Baltimore, Md. Environmental Center.
PERFORMANCE OF SIMPLE MODELS FOR STACK PLUME DISPERSION DURING CONVECTIVE CONDITIONS Final Report
Jeffrey C. Weil Apr. 1980 45 p refs
(PB80-191869; PPSP-MP-30) Avail: NTIS HC A03/MF A01 CSCL 04A

Tests of two simple approaches for predicting ground-level concentrations during unstable conditions, the Gaussian plume and the Venkatram models, are presented. The Gaussian model was chosen because of its widespread use and the controversy surrounding the choice of dispersion parameters used in it. The Pasquill-Gifford A and B stability classes and the Brookhaven National Laboratory B2 Class were tested. The Venkatram model is based on recent theoretical ideas concerning the structure of the convectively mixed layer and dispersion of pollutants within it. GRA

N80-33002# State Univ. of New York, Plattsburgh. Inst. for Man and Environment.
EFFICIENT ALGORITHMS FOR SOLVING SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS FOR ECOSYSTEM MODELING Final Report, Jul. 1977 - Aug. 1978
John Malanchuk, John Otis, and Hubert Bouver Mar. 1980 157 p refs Prepared in cooperation with Applied Physics Lab., Laurel, Md.
(Grant EPA-R-805452)
(PB80-190986; EPA-600/3-80-037) Avail: NTIS HC A08/MF A01 CSCL 06E

Three packages of subroutines for the numerical solution of systems of first order ordinary differential equations are presented. The three integration methods were chosen to provide an efficient means of solving the full range of initial value problems encountered in basin ecosystem modeling. The subroutines have been designed to handle all aspects of the numerical integration as automatically as possible so that their successful use does not require a sophisticated knowledge of the techniques of numerical analysis. After general introduction to the principles and concepts of numerical integration, the particular methods used in the codes are discussed in some detail. Full instructions for use are given, and some simple examples are presented. GRA

N80-33003# Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
SEDIMENT BACTERIA AS A WATER QUALITY INDICATOR IN THE LYNNHAVEN ESTUARY
Carl W. Erkenbrecher, Jr. Jun. 1980 125 p refs Prepared in cooperation with Old Dominion Univ., Norfolk
(PB80-192354; VPI-VWRRC-BULL-126; WBO-05467; OWRT-A-080-Va-1) Avail: NTIS HC A06/MF A01 CSCL 06F

The sediment throughout the estuary had a broad range in total coliforms, fecal coliforms, and fecal streptococci. The densities of benthic indicator bacteria, when expressed on a volumetric basis, were significantly greater than counts in the overlying waters. These counts were indicative of a fecally polluted system. Based on calculated fecal coliform to fecal streptococci ratios, the primary sources of the Lynnhaven's bacterial pollution appeared to be typical of urban and agricultural runoff. The sediments in the Lynnhaven serve as a reservoir for indicator bacteria in densities sufficient to pose potential health hazards. Disturbance in the uppermost sediment layer could cause the resuspension of existing fecal pollution. The results of this study show the urgent need to study more closely the significance of disease causing bacteria in sediments characterized by high levels of fecal pollution. GRA

N80-33004# Hydrocomp, Inc., Mountain View, Calif.
USER'S MANUAL FOR HYDROLOGICAL SIMULATION PROGRAM: FORTRAN (HSPF) Final Report, Nov. 1976 - 30 Nov. 1978
Robert C. Johanson, John C. Imhoff, and Harley H. Davis, Jr. Apr. 1980 686 p
(Grant EPA-R-804971)
(PB80-191109; EPA-600/9-80-015) Avail: NTIS HC A99/MF A01 CSCL 08H

The Hydrological Simulation Program FORTRAN (HSPF) is a set of computer codes that can simulate the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams and well mixed impoundments. The manual discusses the modular structure of the system, the principles of structured programming technology, and the use of these principles in the construction of the HSPF software. In addition to a pictorial representation of how each of the 500 subprograms fits into the system, the manual presents a detailed discussion of the algorithms used to simulate various water quality and quantity processes. GRA

N80-33005# SRI International Corp., Menlo Park, Calif.
METHODOLOGIES TO CONDUCT REGULATORY IMPACT ANALYSIS OF AMBIENT AIR QUALITY STANDARDS FOR CARBON MONOXIDE Final Report
Waheed Siddiqee, Andre Dermant, and Robert Patterson Dec. 1979 92 p refs
(Contract EPA-68-02-2835)
(PB80-192461; SRI-6780; EPA-450/5-80-006) Avail: NTIS HC A05/MF A01 CSCL 13B

A methodology developed to analyze mobile source emission reductions needed to attain alternative proposed national ambient air quality standards for carbon monoxide is described. A costing routine is part of the procedure. The methodology was used in the carbon monoxide regulatory impact analysis for alternative national air standards. GRA

N80-33006# Southern Research Inst., Birmingham, Ala.
HIGH RESISTIVITY BEHAVIOR OF HOT-SIDE ELECTROSTATIC PRECIPITATORS Final Report, Oct. 1978 - Oct. 1979
Roy E. Bickelhaupt Apr. 1980 40 p refs
(Contract EPA-68-02-2610)
(PB80-193071; EPA-600/7-80-076) Avail: NTIS HC A03/MF A01 CSCL 13B

The buildup of a thin layer of sodium on depleted fly ash which has a high electrical resistivity near the collector plate is described. Experiments were done in a miniature corona discharge device under thermal and environmental conditions simulating a hot side electrostatic precipitator. Current density voltage curves were taken with positive negative corona using a hand placed

ash layer 5 mm thick. The effect on current density voltage relationships of: long exposure to negative corona, long exposure to positive corona, and cyclic exposure to negative and positive corona is evaluated. GRA

N80-33007# Industrial Environmental Research Lab., Research Triangle Park, N. C. Particulate Technology Branch.
TI-59 PROGRAMMABLE CALCULATOR PROGRAMS FOR IN-STACK OPACITY, VENTURI SCRUBBERS, AND ELECTROSTATIC PRECIPITATORS User Manual, Jul. 1978 - Jul. 1979
S. J. Cowen, D. S. Ensor, and L. E. Sparks May 1980 165 p refs
(Grant EPA-R-805650)
(PB80-193147; EPA-600/8-80-024) Avail: NTIS HC A08/MF A01 CSCL 13B

The basic concepts of in stack opacity as measured by in stack opacity monitors are explained. Calculator programs that model the performance of venturi scrubbers and electrostatic precipitators are included. The effect of particulate control devices on in stack opacity was predicted by using these programs. The size distribution data input was either in lognormal or histogram format. The opacity was calculated using Deirmendjian's approximation to Mie series to obtain extinction efficiencies. An alternative opacity program employing the exact Mie series solution is described. GRA

N80-33008# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
CATALYST EFFECTIVENESS OF HIGH MILEAGE IN USE VEHICLES
Lois Platte Dec. 1979 15 p
(PB80-192776; EPA-AA-TEB-80-5) Avail: NTIS HC A02/MF A01 CSCL 13B

The inadequate performance of the catalyst due to the effects of deterioration from aging or mileage accumulation was analyzed. The useful life of light duty vehicles was defined as 50,000 miles or 5 years in Federal regulations. The effectiveness of the catalyst on vehicles that are beyond their useful life is drastically reduced. The higher mileage vehicles contribute to increased hydrocarbon levels since many catalyst equipped automobiles now on the road have reached the 5 year or 50,000 mile mark. GRA

N80-33009# Association of Bay Area Governments, Berkeley, Calif.
APPLICATION OF PHOTOCHEMICAL MODELS. VOLUME 1: THE USE OF PHOTOCHEMICAL MODELS IN URBAN OZONE STUDIES Final Report
Ronald Y. Wada, M. Jane Wong, Eugene Y. Leong, Lewis H. Robinson, Rob E. DeMandel, Tom E. Perardi, Michael Y. Kim, William H. Duewer, Steven D. Reynolds, and Larry E. Reid Dec. 1979 167 p refs Prepared in cooperation with Bay Area Air Quality Management District, San Francisco; California Univ., Lawrence Livermore Lab., and Systems Applications, Inc., San Rafael, Calif. 4 Vol.
(Contract EPA-68-02-3046)
(PB80-192495; EPA-450/4-79-025-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

Based largely on recent experience gained in photochemical model applications in the San Francisco Bay Area and in Denver, the guidance is directed toward potential model users in other ozone non attainment areas. The guidance covers the following tasks: model selection; data collection and model input preparation including meteorological and topographical data, emission inventory data, ambient air quality data, treatment of initial and boundary conditions, and special field studies; the evaluation of photochemical model performances; model applications; and interpretation of model results with respect to attainment of the Federal ozone standard. GRA

N80-33010# Fluidyne Engineering Corp., Minneapolis, Minn.
EFFECTIVE SAMPLING TECHNIQUES FOR PARTICULATE EMISSIONS FROM ATYPICAL STATIONARY SOURCES Final Report, Feb. 1977 - Jan. 1980
D. P. Saari and H. A. Hanson Jan. 1980 200 p refs
(Contract EPA-68-02-1796)
(PB80-185549; EPA-600/2-80-034) Avail: NTIS HC A09/MF A01 CSCL 13B

Sampling techniques for measuring particulate emissions from four 'atypical' stationary source categories were developed and evaluated. The categories included low effluent velocity streams, extended dimensions, partially or totally unconfined flow, and saturated gas streams or gas streams with entrained liquid droplets. Research included literature surveys, laboratory model testing, and field testing of instruments and techniques on three specific sources: gravity roof ventilators, grain dryers, and wet scrubbers. GRA

N80-33011# Southern Research Inst., Birmingham, Ala.
CHARGE MEASUREMENTS OF PARTICLES EXITING ELECTROSTATIC PRECIPITATORS Final Report, Oct. 1978 - Oct. 1979
J. R. McDonald, M. H. Anderson, and R. B. Mosley Apr. 1980 50 p refs
(Contract EPA-68-02-2610)
(PB80-187438; SORI-EAS-80-332; Rept-3858-10; EPA-600/7-80-077) Avail: NTIS HC A04/MF A01 CSCL 13B

Particle charging in positive and negative corona discharge is discussed as a function of temperature from 38 to 343 C in order to establish, especially at hot side electrostatic precipitator temperatures, the relative effectiveness of the two possible methods of charging. Charge values on individual particles exiting two laboratory ESP's were measured in an experimental apparatus utilizing a Millikan cell. Measurements were directed at the particles with radii between 0.3 and 1.5 micrometers. Measurements were obtained for redispersed fly ash particles carried in air temperatures from 38 to 343 C. GRA

N80-33012# Southwest Research Inst., San Antonio, Tex.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM A MALFUNCTIONING THREE-WAY CATALYST GASOLINE AUTOMOBILE Final Report, Aug. 1978 - Nov. 1979
Charles M. Urban Jan. 1980 171 p refs
(Contract EPA-68-03-2692)
(PB80-187446; SWRI-11-5402; EPA-460/3-80-005) Avail: NTIS HC A08/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from a current model three-way catalyst equipped gasoline automobile operating under malfunction conditions is described. One automobile was evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured in addition to the currently regulated emissions included: particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of the regulated emissions over four short-test procedures. GRA

N80-33013# Automotive Environmental Systems, Inc., Westminster, Calif.
A STUDY OF EXHAUST EMISSIONS FROM 1978-1980 MODEL YEAR THREE-WAY CATALYST VEHICLES IN LOS ANGELES Final Report
Lawrence L. Moore and Alan D. Jones EPA Mar. 1980 269 p
(Contract EPA-68-03-2889)
(PB80-187453; EPA-460/3-80-006) Avail: NTIS HC A12/MF A01 CSCL 13B

Exhaust emission data and other information obtained as a result of the testing and inspection of 350 in-use passenger cars is presented. The test fleet was made up of 1978, 1979 and 1980 automobiles manufactured by Ford, General Motors, Mazda, Saab, Toyota, Volkswagen/Audi and Volvo. Each vehicle was equipped with a three way catalyst control system. The test sequence consisted of the 1975 Federal test procedure (exhaust emissions only), a highway fuel economy test, a two-speed idle test, a Federal three mode test, and a loaded two mode test. After the initial test sequence, each vehicle was subjected to a thorough underhood inspection. GRA

N80-33014# Southern Research Inst., Birmingham, Ala.
PROCEEDINGS: ADVANCES IN PARTICLE SAMPLING AND MEASUREMENT Progress Report, Apr. - Nov. 1979

W. B. Smith, ed. Jan. 1980 9 p refs Proc. held at Daytona Beach, Fla., Oct. 1979
(Contract EPA-68-02-3118)
(PB80-187487; EPA-600/9-80-004) Avail: NTIS HC A02/MF A01 CSCL 13B

Equipment and techniques for sampling and characterizing particulate emissions and other aerosols are addressed. The inhalable particle size range (up to 15 micrometers) is emphasized, and the basis for selecting this range as a standard is discussed. Novel or improved equipment includes: virtual impactors; impactors for sampling high dust loadings; an impactor/quartz-crystal-microbalance combination used to sample stratospheric aerosols; a tapered-element oscillating microbalance for monitoring particulate emissions and aerosols; an automated piezoelectric microbalance for monitoring atmospheric aerosols; a hot-wire probe for measuring liquid droplets; sampling systems for measuring mass emissions; and more efficient sampling probe inlets. GRA

N80-33015# Wisconsin Univ. - Madison. Dept. of Civil and Environmental Engineering.
PERFORMANCE EVALUATION OF EXISTING AERATED LAGOON SYSTEM AT CONSOLIDATED KOSHKONONG SANITARY DISTRICT, EDGERTON, WISCONSIN Final Report, 20 Jul. 1975 - 30 Jun. 1977
Lawrence B. Polkowski Dec. 1979 125 p refs
(Grant EPA-R-803930)
(PB80-189681; EPA-600/2-79-182) Avail: NTIS HC A06/MF A01 CSCL 13B

Aerated treatment lagoons are used throughout the United States to provide secondary treatment of municipal wastewaters. The data available to assess the performance of these systems are lacking partially as a result of the infrequent sampling and limited types of analyses performed. Evaluation of the performance of a well designed, three cell aerated lagoon system over a twelve month period is discussed. The Consolidated Koshkonong Sanitary District's treatment system in Wisconsin is subject to a climate with large seasonal variations. The treatment system performed well in removing BOD5 and total suspended solids as well as producing an effluent with acceptable pH and coliform counts. GRA

N80-33016# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
ROCK FILTERS FOR REMOVAL OF ALGAE FROM LAGOON EFFLUENTS Final Report, 1977 - 1978
Gregory R. Swanson and Kenneth J. Williamson Mar. 1980 93 p refs
(Grant EPA-R-805416)
(PB80-190077; EPA-600/2-80-038) Avail: NTIS HC A05/MF A01 CSCL 13B

Rock filtration was shown to be an effective, low cost unit process for removing algae from lagoon effluents and correspondingly upgrading lagoon treatment. Sedimentation is the primary mechanism of algal removal within rock filter. The settling rates of three species of algae common to lagoons were measured as varying from 0.02 to 0.3 m/day, depending on species and temperature. A mathematical model of the sedimentation mechanism was constructed based on discrete settling theory. A full scale horizontal flow operating rock filter designed for a maximum hydraulic loading of 0.28 cu m/cu m was evaluated. GRA

N80-33017# Southwest Research Inst., San Antonio, Tex. Dept. of Emissions Research.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM MALFUNCTIONING NON-CATALYST AND OXIDATION CATALYST GASOLINE AUTOMOBILES Final Report, Dec. 1978 - Apr. 1979
Charles M. Urban Jan. 1980 308 p refs
(Contract EPA-68-03-2499)
(PB80-190473; EPA-460/3-80-003) Avail: NTIS HC A14/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from non-catalyst and oxidation catalyst-equipped gasoline automobiles operating under malfunction conditions is described. One non-catalyst and four catalyst-equipped automobiles were evaluated over three driving schedules in the unmodified and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. GRA

N80-33018# Environmental Protection Agency, Ann Arbor, Mich. Inspection and Maintenance Staff.
EFFECTS OF GASOHOL ON IDLE HC AND CO EMISSIONS
Thomas Darlington and Richard Lawrence Mar. 1980 19 p refs
(PB80-190655; EPA-AA-IMS/ST-80-4; TEB-80-13) Avail: NTIS HC A02/MF A01 CSCL 13B

A test program was run to investigate the effects of gasohol on CO and HC emissions on an I/M idle test. Three vehicles were set up to operate on either gasoline or gasohol. A Hamilton emissions analyzer was used to measure tailpipe emissions. CO emissions were varied in each of the cars by adjusting the idle mixture screw, and HC emissions were varied by inducing a misfire with a misfire generator. At each CO and HC value as specified in the program, the fuel was switched from gasoline to gasohol while its effect was noted on tailpipe emissions. The data obtained provided a basis for determining gasohol's ability to reduce CO and HC emissions for an idle test. GRA

N80-33019# Southern Research Inst., Birmingham, Ala.
A MATHEMATICAL MODEL OF ELECTROSTATIC PRECIPITATION, REVISION 2 Progress Report, Jan. 1976 - Dec. 1978
R. B. Mosley, M. H. Anderson, and J. R. McDonald Feb. 1980 402 p refs
(Contract EPA-68-02-2193)
(PB80-190994; SORI-EAS-80-065-Rev-2; EPA-600/7-80-034; SRI-3777-1) Avail: NTIS HC A18/MF A01 CSCL 13B

Modifications to a computer model of electrostatic precipitation (ESP) are described. The modifications include a new semi-empirical approximation procedure for predicting electrical conditions in an ESP. Comparisons between the results from the approximation procedure and more exact procedures are presented. A new integration procedure for calculating particle charge is also presented. Complete FORTRAN listings for the revised ESP model and the new subprograms are provided. Example problems are included. The modified model requires significantly less computer time than does the earlier model. Comparisons of results obtained using the earlier and the modified models over a wide range of possible ESP geometries and electrical operating points indicate that for practical purposes the modified model can be used in place of the more rigorous earlier model. GRA

N80-33020# Southwest Research Inst., San Antonio, Tex. Dept. of Emissions Research.
REGULATED AND UNREGULATED EXHAUST EMISSIONS FROM MALFUNCTIONING THREE-WAY CATALYST GASOLINE AUTOMOBILES Final Report, Aug. 1977 - Sep. 1979
Charles M. Urban Jan. 1980 241 p refs
(Contract EPA-68-03-2588)
(PB80-190804; EPA-460/3-80-004) Avail: NTIS HC A11/MF A01 CSCL 13B

The laboratory effort to characterize regulated and unregulated exhaust emissions from three-way catalyst equipped gasoline automobiles operating under malfunction conditions is described. Three automobiles were evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include: particulate, sulfates, aldehydes, sulfides, amines, metals, and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of regulated emissions over four short cycle procedures. GRA

N80-33021# National Technical Information Service, Springfield, Va.
AIRCRAFT AIR POLLUTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1980

Diane M. Cavagnaro Jul. 1980 215 p Supersedes NTIS/PS-79/0645 and NTIS/PS-78/0623
(PB80-812332; NTIS/PS-79/0645; NTIS/PS-78/0623) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

Pollution control and abatement, emission data and emission factors, stratospheric pollution, effects the supersonic transport traffic have on the environment, and pollutant concentrations and movement around airports and flight corridors are discussed in this updated bibliography containing 209 citations, 65 of which are new entries to the previous edition. GRA

N80-33022# Performance Development Inst., Washington, D.C.
INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP POLICY RESEARCH SERIES. VOLUME 1: EMISSION OFFSET POLICY AT WORK. A SUMMARY ANALYSIS OF 8 CASES Final Report
William H. Foskett Apr. 1980 50 p refs
(Contract NBS-7-83603)
(PB80-187610; NBS-GCR-ETIP-80-86) Avail: NTIS HC A03/MF A01 CSCL 13B

The Emission Offset Interpretative Ruling is analyzed into its administrative components. Eight permit applications involving emission offsets provide data describing the administrative functioning of the offset policy in terms of these components. Offsets were easy to find, but the process for determining lowest achievable emission reduction was complex. Third parties promoting local economic development were an important factor in locating offsets. Technological innovation involved development of new control techniques and diffusion of known technology to uncontrolled sources of emissions. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-33023# Ohio State Univ., Columbus. Research Foundation.
POTENTIAL COEFFICIENT AND ANOMALY DEGREE VARIANCE MODELLING REVISITED
Richard H. Rapp Sep. 1979 23 p refs
(Contract F19628-79-C-0027)
(AD-A082322; AFGL-TR-79-0245; SR-2) Avail: NTIS HC A02/MF A01 CSCL 08/14

The decay of the power spectrum of the Earth's gravitational potential was modeled using the GEM 10B solution of NASA and a solution complete to degree 180 at OSU. The modelling was first done using the form of A/lambda sub B where A and B were parameters determined by various adjustment techniques. For degrees through 36, the best estimate of A is 10.6 x 10 to the -6 power and B = 2.17 based on the GEM 10B data. Earlier models by Kaula and Tscherning/Rapp contain too much power as compared to the actual field beyond degree 8. Anomaly degree variance models were also computed from the anomaly degree variances of the 180 solution and other data such as a point anomaly variance, and a horizontal gradient variance. With this data, it was found that the parameters of the earlier Tscherning/Rapp model are still valid provided a high gradient variance is acceptable. Excellent fit to all data types is obtained with the two component model suggested by Moritz. All models used are compared in terms of common parameters such as point anomaly variance, gradient variance, undulation variance and fits to observed potential coefficient variations. A.R.H.

N80-33024*# Lamont-Doherty Geological Inst., Palisades, N. Y.
THEORY OF TIME-DEPENDENT RUPTURE IN THE EARTH
Shamita Das and Christopher H. Scholz 3 Sep. 1980 53 p refs
(Grant NGR-33-008-146)
(NASA-CR-163567) Avail: NTIS HC A04/MF A01 CSCL 08K

Fracture mechanics is used to develop a theory of earthquake mechanism which includes the phenomenon of subcritical crack growth. The following phenomena are predicted: slow earthquakes, multiple events, delayed multiple events (doublets), postseismic rupture growth and afterslip, foreshocks, and aftershocks. The theory predicts a nucleation stage prior to an earthquake, and suggests a physical mechanism by which one earthquake may 'trigger' another. S.F.

N80-33025# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IONOSPHERIC F-REGION RESPONSE TO GEOMAGNETIC STORMS, OVER BRAZILIAN LOW LATITUDE
M. A. Abdu, I. J. Kantor, E. R. DePaula, and A. C. Giese Jul. 1980 21 p refs Presented at the 32d Ann. Meeting of SBPC Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1835-RPE/197) Avail: NTIS HC A02/MF A01

Ionosonde data from Cachoeira Paulista are analyzed to study the response of the ionospheric F region electron densities and heights to magnetic storm disturbances of moderate to strong intensity. The ionospheric response was found to be highly variable from one storm to another, depending upon the intensity, duration and the definitions of the different phases of the magnetic storm. Certain characteristics of the ionospheric response over Cachoeira Paulista are: in general, the ionosphere appears relatively more disturbed during the night than during the day; during the main phase of the magnetic storm, the F region maximum electron density generally presents significant enhancements; and significant depletion in the ionization occurs during the recovery phase of the storm. The changes in the height of the layer are not well defined, except in rare cases when it shows variations in opposite sense to that of the electron density. These results are interpreted in terms of the extension, to low latitude, of the storm induced midlatitude thermospheric disturbances in composition and transport. R.K.G.

N80-33026# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PLASMA IRREGULARITIES IN THE TROPICAL F-REGION DETECTED BY OI 7774 A AND 6300 A NIGHTGLOW MEASUREMENTS
Y. Sahai, J. A. Bittencourt, N. R. Teixeira, and H. Takahashi Aug. 1980 18 p refs Sponsored by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1844-RPE/204) Avail: NTIS HC A02/MF A01

Simultaneous measurements of the permitted OI 7774 A and the forbidden OI 6300 A nightglow emissions were carried out. Both emissions were observed with tilting filter type photometers. During spread F conditions, both emissions showed simultaneous short time large intensity depletions, indicatig the presence of large scale irregularities in the F regions. S.F.

N80-33027# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WAVE DISTURBANCES IN THE LOW LATITUDE IONOSPHERE AND EQUATORIAL IONOSPHERE PLASMA DEPLETIONS
J. H. A. Sobral, M. A. Abdu, I. S. Batista, and C. J. Zamlutti Jun. 1980 16 p refs Presented at the 32d Ann. Meeting of the SBPC, Jul. 1980 Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1806-RPE/174) Avail: NTIS HC A02/MF A01

An isolated nightime inospheric wave disturbance was observed by a meridional scanning 6300 a photometer, a 6300 a zenith photometer, a 30 MHz riometer and an ionosonde. Two different scale size for the disturbances are: a larger scale component easily identified in the riometer data similar to those of a large scale TID and smaller scale disturbance observable in the scanning photometer data, occurring during the ascending phases of the larger scale waves. A Fourier analysis of the zenith airglow variations reveals a dominant period of about 104 minutes. No single dominant period is presented for the smaller scale waves. All waves have a poleward velocity component: the smaller scale waves show this feature more markedly. The equatorial source of the smaller scale disturbance suggests that these are perhaps the low altitude manifestations of the upward propagating field aligned plasma bubbles in the equatorial ionosphere. S.F.

N80-33028# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GRAVITY WAVE INDUCED IONIZATION LAYERS IN THE NIGHT F-REGION AT LOW LATITUDES
M. A. Abdu, I. S. Batista, I. J. Kantor, and J. H. A. Sobral Jun. 1980 21 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1759-RPE/148) Avail: NTIS HC A02/MF A01

Ionosone observations over Cachoeira Paulista (22 S, 45 W) a low latitude station, show distorted h prime (f) traces in the ionograms due to passage of TID's. The disortions of the traces, at times take the form of an F-region bifurcated into two distinct layers. These effects are observed mostly during presunrise hours. The characteristics of the electron density and height oscillations suggest either presence of low energy (< 10 KeV) electron precipitation in the South Atlantic Geomagnetic Anomaly and/or ionization convergence due to horizontal shears in the gravity wave producting the TID's. Author

N80-33029# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF CHANGES IN THE IONOSPHERIC TOTAL ELECTRON CONTENT AT MID-LATITUDE LOCATIONS FEW HUNDRED KILOMETERS APART
R. P. Kane Jun. 1980 22 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1798-RPE/168) Avail: NTIS HC A02/MF A01

The changes in the ionospheric TEC (total electron content) at the three North American locations Stanford (37 N, 112 W), Clark Lake (33 N, 116 W) and Rosman (35 N, 83 W) are compared for about 260 days in 1971. Apart considerable day to day changes (approximation 30 percent) in the daily ranges of TEC even on quiet days at all the three locations, the changes at Stanford and Clark Lake differed between themselves sometimes by as much as 30 percent and those between this pair and Rosman by as much as 50 percent indicating random components of local origin of scales as small as a few hundred km and as large as a few thousand km. R.K.G.

N80-33030# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOME CHARACTERISTICS OF SPREAD F AT MAGNETIC EQUATORIAL STATION FORTALEZA
M. A Abdu, I. S. Batista, and J. A. Bittencourt Jun. 1980 20 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico
(INPE-1758-RPE/147) Avail: NTIS HC A02/MF A01

Spread F in ionograms of both the range and frequency spread types is studied for the magnetic equatorial station Fortaleza (38 degrees W, 3 degrees S) for a one year period during 1978-79. The TID type disturbances in the evening equatorial ionosphere are found to be a necessary prerequisite for the generation of the instabilities giving rise to the range type spread F, whereas frequency type spread F is formed under different circumstances. Striking differences are noted in the spread F characteristics and related parameters over Fortaleza as compared to Huancayo and Jicamarca, situated within only 38 degrees in longitude west of Fortaleza. The post sunset maximum in winter is delayed by about one and a half hours with respect to other seasons over Fortaleza, as compared to Huancayo, where it occurs earlier in winter than in other seasons. Similar differences exist also in the prereversal peak near sunset in the vertical drift velocity (Vz) between Fortaleza and Jicamarca. S.F.

N80-33031# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SEASONAL VARIATION OF OZONE IN THE MESOSPHERE
V. W. J. H. Kirchhoff, B. R. Clemesha, and D. M. Simonich Jun. 1980 16 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1800-RPE/170) Avail: NTIS HC A02/MF A01

The mesospheric ozone density at a height of 88 km was deduced from simultaneous ground based observations of neutral sodium density and sodium nightglow intensity, using a photochemical equilibrium model. Sodium densities were measured as a function of height between 76 and 106 km by laser radar, and the nightglow intensities by a tilting filter photometer. The ozone density shows a strong seasonal variation with well defined maxima at the equinoxes, and a mean annual value of 8 X 10 to the 7th power/cubic centimeter. The average nocturnal variation shows a factor of 2 increase between sunset and sunrise. S.F.

N80-33032# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIMULTANEOUS MEASUREMENTS OF OH(9,4), (8,3), (7,2), (6,2) AND (5,1) BANDS IN THE AIRGLOW
H. Takahashi and P. P. Batista Jun. 1980 39 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1801-RPE/171) Avail: NTIS HC A03/MF A01

Band intensities and the rotational temperatures for the OH(9,4), (8,3), (7,2), (6,2) and (5,1) bands were measured by means of a multichannel tilting filter photometer at Cachoeira Paulista, Brazil. The nocturnal variations of the five bands show good correlation between them, but there are small differences in the amplitudes of the variations between the bands from the upper vibrational levels and those from the lower levels. The cross correlation between the band intensities show that the nocturnal variations of the upper vibrational bands lead those of the lower levels. Vibrational population rates and initial excitation rates for each vibrational level are calculated. An increase of the initial excitation rate in the v = 5 and v = 6 levels was observed. The different features of the intensity variations and the excitation rates of the lower vibrational levels suggest the existence of the mechanism HO2 + O yields OH + O2, capable of exciting OH to the v = 5 and v = 6 levels, in addition to the principal mechanism, assumed to be the reaction H + O3 yields OH + O2. R.K.G.

N80-33033*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REGIONAL ANALYSIS OF EARTHQUAKE OCCURRENCE AND SEISMIC ENERGY RELEASE
S. C. Cohen Aug. 1980 16 p refs Submitted for publication
(NASA-TM-81994) Avail: NTIS HC A02/MF A01 CSCL 08K

The historic temporal variation in earthquake occurrence and seismic energy release on a regional basis throughtout the world were studied. The regionalization scheme employed divided the world into large areas based either on seismic and tectonic considerations (Flinn-Engdahl Scheme) or geographic (longitude and latitude) criteria. The data set is the wide earthquake catalog of the National Geophysical Solar-Terrestrial Data Center. An apparent relationship exists between the maximum energy released in a limited time within a seismic region and the average or background energy per year averaged over a long time period. In terms of average or peak energy release, the most seismic regions of the world during the 50 to 81 year period ending in 1977 were Japanese, Andean South American, and the Alaska-Aleutian Arc regions. The year to year fluctuations in regional seismic energy release are greater, by orders of magnitude, than the corresponding variations in the world-wide seismic energy release. The b values of seismic regions range from 0.7 to 1.4 where earthquake magnitude is in the range 6.0 to 7.5. T.M.

N80-33034# RDP, Inc., Waltham, Mass.
DATA PROCESSING SUPPORT FOR EXPERIMENTAL STUDIES OF THE UPPER ATMOSPHERE Final Report, 5 Apr. 1977 - 31 Dec. 1979
Marcel Schneeberger, Harold Fish, Jacobus D. deClercq Zubli, Muriel C. Hervey, and Walter Gleason AFGL Feb. 1980 73 p refs
(Contract F19628-77-C-0167; AF Proj. 0993)
(AD-A087943; AFGL-TR-80-0076) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes the data processing support provided to reduce a variety of rocket-, satellite-, falling sphere-, and balloon-borne sensor data for analysis by Air Force scientists engaged in atmospheric research projects. GRA

N80-33035# Naval Postgraduate School, Monterey, Calif. Environmental Physics Group.
OPTICAL AEROSOL SPECTROMETERS FACTORS AFFECT-

ING OPTICAL EXTINCTION PREDICTIONS Technical Report, May 1978 - Jun. 1979
G. E. Schacher, K. L. Davidson, and C. W. Fairall (BDM Corp.) 19 Apr. 1980 97 p refs Sponsored in part by California Air Resources Board
(AD-A087656; NPS61-80-013) Avail: NTIS HC A05/MF A01 CSCL 04/1

Optical aerosol counters are used to measure aerosol spectra and thence to calculate the aerosol contribution of optical extinction. This report contains the results of field experiments and laboratory investigations of the performance of the NPS spectrometers. Areas of concern in the use of these spectrometers and the subsequent calculations are identified and discussed. In general the spectrometer performance is adequate for use in predicting the performance of overocean optical systems. GRA

N80-33038# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
INTERPRETATION OF DATA FROM UPHOLE REFRACTION SURVEYS Final Report
Arley G. Franklin Jun. 1980 73 p refs
(AD-A087775; WES/MP/GL-80-5) Avail: NTIS HC A04/MF A01 CSCL 17/10

The conventional interpretation of the data from an uphole refraction survey is based on the similarity between a plot of contours drawn on uphole arrival times and a wave-front diagram, which shows successive positions of the wave front produced by a single shot location at the ground surface. However, the two are alike only when the ground consists solely of homogeneous strata, oriented either horizontally or vertically. In this report, the term 'Meissner diagram' is used for the plot of arrival times from the uphole refraction survey in order to maintain the distinction between it and a true wave-front diagram. Where departures from the case of homogeneous, horizontal strata exist, the interpretation of the Meissner diagram is not straightforward, although a partial interpretation in terms of a horizontally stratified system is usually possible. A systematic approach to the interpretation problem, making use of such a partial interpretation, is proposed. GRA

N80-33037# Naval Research Lab., Washington, D. C.
ON 11 CM IRREGULARITIES DURING EQUATORIAL SPREAD F Interim Report
J. D. Huba 17 Jul. 1980 23 p
(RR00330244)
(AD-A087751; AD-E000501; NRL-MR-4271) Avail: NTIS HC A02/MF A01 CSCL 17/9

The recent Kwajalein radar backscatter observation of 11 cm irregularities at high altitudes (approximately 500 km) during equatorial spread F are explained in terms of the kinetic lower-hybrid-drift instability. The absence of radar backscatter from 11 cm irregularities at lower altitudes (approximately 240 km) is attributed to the stabilizing influence of electron-neutral collisions. GRA

N80-33038# Air Force Geophysics Lab., Hanscom AFB, Mass. Composition Branch.
ION PRODUCTION IN THE D-REGION Interim Report
William Swider 14 May 1980 20 p refs
(AF Proj. 2310)
(AD-A085533; AFGL-TR-80-0156) Avail: NTIS HC A02/MF A01 CSCL 04/1

Ionization processes for the D region are reviewed. Levels of ionization range from the fairly steady rates produced through galactic cosmic rays to the large rates generated during solar flares and associated geomagnetic storms. The normal quiescent daytime D region is ionized by solar UV radiation available because of certain windows and solar X-rays, although this latter source is generally weak. Cosmic rays are important roughly below 65 km. At night, stellar X-ray sources may be important along with precipitating electrons at high latitudes from the magnetosphere. Solar flares can result in ionization rates due to X-rays, electrons or nuclei which are greatly enhanced over quiet conditions. Typical ionization production rates from these various sources are illustrated. J.M.S.

N80-33039# Naval Research Lab., Washington, D. C.
THE MICROWAVE APPLICATIONS THEORY PROGRAM AT NRL AND SOME CHEMISTRY CODE APPLICATIONS TO IONOSPHERIC HEATING BY MICROWAVE RADIATION Interim Report
A. W. Ali 26 Aug. 1980 35 p refs
(WF34372501)
(AD-A088275; NRL-MR-4302) Avail: NTIS HC A03/MF A01 CSCL 04/1

A brief outline of the Microwave Applications program at NRL is presented. The goal of the program is to develop comprehensive codes for microwave air breakdown and microwave interaction with matter which can easily be applied for a wide range of applications. Also presented are results of microwave energy deposition in the ionosphere using the NRL Master Code for the disturbed E and F regions. Time histories of oxygen metastable states are presented for several levels of microwave power. From these, emission at 5577 A and 6300 A can be obtained. GRA

N80-33040# Aeronautical Research Associates of Princeton, Inc., N. J.
RESONANT INTERACTIONS OF SURFACE AND INTERNAL GRAVITY WAVES
Harvey Segur 1980 9 p refs
(Contract N00014-80-C-0048)
(AD-A088324; ARAP-TM-80-10) Avail: NTIS HC A02/MF A01 CSCL 20/4

A stably stratified, two-layer fluid system with a free surface admits resonant triads, including ones involving one surface and two internal waves. Resonant triads that couple surface and internal gravity waves are thought to play an important role in transferring energy from wind-generated surface waves to internal waves. Ball used a geometric construction to show that the linearized dispersion relation for a two-layer liquid system with a free upper surface and no stream velocity admits resonant triads. GRA

N80-33041*# Rice Univ., Houston, Tex.
QUANTITATIVE SIMULATION OF A MAGNETOSPHERIC STORM. 3: PLASMASPHERIC ELECTRIC FIELDS AND EVOLUTION OF THE PLASMAPAUSE
R. W. Spiro, M. Harel, R. A. Wolf, and P. H. Reiff 25 Jan. 1980 48 p refs
(Grant NGR-44-006-137; Contract F19628-77-C-0005; Grant NSF ATM-74-21185; AF Proj. 2311)
(NASA-CR-163455; AD-A087948; SR-4; AFGL-TR-80-0130) Avail: NTIS HC A03/MF A01 CSCL 04/1

Results of the Rice University substorm simulation have been used to investigate the penetration of substorm-associated electric fields into the plasmasphere. Near 4 RI(E) in the equatorial plane, our time-dependent electric field model is characterized by eastward components in the dusk-midnight local time sector and westward components after midnight. Except for a small region just before dusk the model predicts eastward electric field components throughout the daytime sector. The characteristic radial component is directed inward at all local times except for a small region just after dawn. These results compare favorably with available whistler and incoherent scatter measurements obtained during magnetically disturbed periods. By assuming an initial plasmapause shape and by following the computed E x B drift trajectories of plasma flux tubes from that initial boundary we have examined the short-term evolution of the plasmapause during the substorm-like event of 19 September 1976. We find that narrow filamentary tails can be drawn out from the plasmasphere near dusk within hours of substorm onset. These tail-like appendages to the plasmasphere subsequently drift rapidly from the dust sector toward the daytime magnetopause. Investigation of the large-scale time-dependent flow of plasma in the evening sector indicates that some mid-latitude plasma flux tubes that drift eastward past the dusk terminator reverse their motion between dusk and midnight and begin to drift westward toward dusk. Such time-dependent changes in flow trajectories may be related to the formation of F-region ionization troughs. GRA

N80-33042# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
ATMOSPHERIC TRANSMITTANCE/RADIANCE: COMPUTER CODE LOWTRAN 5

F. X. Kneizys, E. P. Shettle, W. O. Gallery, J. H. Chetwynd, Jr., L. W. Abreu, R. A. McClatchey, R. W. Fenn, and J. E. A. Selby 21 Feb. 1980 228 p refs
(AF Proj. 7670)
(AD-A088215; AFGL-TR-80-0067; AFGL-ERP-697) Avail: NTIS HC A11/MF A01 CSCL 04/1

This report describes a computer code for predicting atmospheric transmittance and the thermal radiation emitted by the atmosphere and Earth from 350 to 40,000 per cm at a spectral resolution of 20 per cm. The program is based on the LOWTRAN 4 (1978) computer code. New altitude and relative humidity dependent aerosol models and new fog models are included in the code. In addition, the new code structure consists of a main program and 19 subroutines. The computer code contains representative (geographical and seasonal) atmospheric models and representative aerosol models with an option to replace them with user derived or measured values. The program can be run in one of two modes, namely, to compute only atmospheric transmittance or both atmospheric transmittance and radiance for any given slant path geometry. GRA

N80-33043# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOMAGNETIC INDEX CALCULATION AND USE AT AFGWC
Robert D. Prochaska Apr. 1980 34 p refs
(AD-A088234; AFGWC/TN-80/002) Avail: NTIS HC A03/MF A01 CSCL 08/14

At Air Force Global Weather Central (AFGWC) several geomagnetic indices to specify the state of the magnetosphere were used. In this paper it introduces the indices of geomagnetic activity most commonly in use by DOD agencies. It discusses the procedures used at AFGCW to compute the indices and briefly describes the uses of each one. GRA

N80-33044# California State Univ. at Long Beach.
PRECISION GRAVITY STUDIES AT CERRO PRIETO: THE SECOND YEAR
R. B. Grannell, D. W. Tarman (California Polytechnic Inst., Pomona), R. C. Clover, R. M. Leggewie, P. S. Aronstam, R. C. Kroll, and J. Eppink (California Polytechnic Inst., Pomona) 1979 5 p refs Presented at 2d Symp. on the Cerro Prieto Geothermal Field, Baja Calif., Mexico, 17-19 Oct. 1979 Sponsored in part by Comision Federal de Electricidad
(Contract W-7405-eng-48)
(LBL-9551; CONF-7910166-5) Avail: NTIS HC A02/MF A01

Precision gravity measurements were initiated at Cerro Prieto in 1978. Interpretation of the first annual repetition of the measurements is presented. Field procedures, data reduction, and data interpretation are reviewed briefly. DOE

N80-33045# SRI International Corp., Menlo Park, Calif.
AIRBORNE MEASUREMENTS OF STRATOSPHERIC OZONE INTRUSIONS INTO THE TROPOSPHERE OVER THE UNITED STATES. VOLUME 1: DATA ANALYSIS AND INTERPRETATION Final Report
William Viezee, Warren B. Johnson, and Harwant B. Singh Sep. 1979 142 p refs
(SRI Proj. 6690)
(PB80-185788; CRC-APRAC-CAPA-15-76A-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 04A

The magnitude, variability, and sources of natural ozone occurring in rural locations, both at the ground and aloft were investigated. Two field programs using an instrumented aircraft were carried out to investigate the downward vertical transport of ozone rich air from the stratosphere as a potential cause of natural tropospheric ozone. The field programs are described and the analysis and interpretation of the collected data are presented. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-33046*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
AN ATLAS OF 1977 AND 1978 GEOS-3 RADAR ALTIMETER DATA FOR TROPICAL CYCLONE STUDIES
H. Ray Stanley (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) and Ronald L. Taylor Aug. 1980 229 p refs
(Contract NAS6-2639)
(NASA-TM-73288) Avail: NTIS HC A11/MF A01 CSCL 04B

All of the GEOS 3 satellite altimeter schedule information were collected with all of the available 1977 and 1978 tropical cyclone positional information. The time period covers from March 23, 1977 through Nov. 23, 1978. The geographical region includes all ocean area north of the equator divided into the following operational areas: the Atlantic area (which includes the Caribbean and Gulf of Mexico); the eastern Pacific area; the central and western Pacific area; and the Indian Ocean area. All available source material concerning tropical cyclones was collected. The date/time/location information was extracted for each disturbance. This information was compared with the GEOS 3 altimeter ON/OFF history information to determine the existence of any altimeter data close enough in both time and location to make the data potentially useful for further study (the very liberal criteria used was time less than 24 hours and location within 25 degrees). Geographic plots (cyclone versus GEOS 3 orbit track) were produced for all of the events found showing the approximate location of the cyclone and the GEOS 3 orbit traces for the full day. T.M.

N80-33047*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A 94/183 GHz MULTICHANNEL RADIOMETER FOR CONVAIR FLIGHTS Final Technical Report, 6 Apr. 1978 - 2 Feb. 1979
J. A. Gagliano, J. A. Stratigos, R. E. Forsythe, and J. M. Schuchardt Jan. 1979 243 p
(Contract NAS5-24480)
(NASA-CR-160032) Avail: NTIS HC A11/MF A01 CSCL 14B

A multichannel 94/183 GHz radiometer was designed, built, and installed on the NASA Convair 990 research aircraft to take data for hurricane penetration flights, SEASAT-A underflights for measuring rain and water vapor, and Nimbus-G underflights for new sea ice signatures and sea surface temperature data (94 GHz only). The radiometer utilized IF frequencies of 1, 5, and 8.75 GHz about the peak of the atmospheric water vapor absorption line, centered at 183.3 GHz, to gather data needed to determine the shape of the water molecule line. Another portion of the radiometer operated at 94 GHz and obtained data on the sea brightness temperature, sea ice signatures, and on areas of rain near the ocean surface. The radiometer used a multiple lens antenna/temperature calibration technique using 3 lenses and corrugated feed horns at 94 GHz and 183 GHz. Alignment of the feed beams at 94 GHz and 183 GHz was accomplished using a 45 deg oriented reflecting surface which permitted simultaneous viewing of the feeds on alternate cycles of the chopping intervals. Author

N80-33048*# Indian Space Research Organization, Bangalore. Meteorological Dept.
THE MONSOON EXPERIMENT MONEX
P. K. Das Sep. 1979 13 p Sponsored by NASA
(NASA-CR-163509; ISRO-SN-08-79) Avail: NTIS HC A02/MF A01 CSCL 04B

The effects of monsoons in different parts of the world on the Earth's atmosphere were studied by MONEX, India's Monsoon Experiment program. Data were gathered from meteorological satellites, sounding rockets, aircraft, land and shipborne stations. S.F.

N80-33049# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STEPWISE LINEAR REGRESSION EXPERIMENTS IN 14- AND 19-DAY HEMISPHERIC WEATHER PREDICTION
S. Srivatsangam Jun. 1980 9 p refs Presented at the Intern. Symp. on Statist. and Probabilistic Weather Prediction, Nice, 8-12 Sep. 1980

(Contract N00228-76-C-3205)
(INPE-1757-RPE/146) Avail: NTIS HC A02/MF A01

The zonal variance of the heights of constant pressure surfaces in the atmosphere is taken to be Markovian, i.e., unpredictable over long times by its own history. It is shown through cross correlation and multiple regression that the zonal variance is predictable over long times at a given location, through its lagged cross correlation at other locations. Author

N80-33050# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A CLIMATOLOGICAL STUDY OF THE TROPOSPHERIC CIRCULATION OVER THE AMAZON REGION

Vernon E. Kousky and Mary T. Kagano Jun. 1980 37 p refs Submitted for publication
(INPE-1761-RPE/150) Avail: NTIS HC A03/MF A01

Climatological and monthly means are computed for radiosonde data at Manaus and Belem (1968-1976). Geopotential height and wind data at upper levels show evidence of the meridional movement of a strongly divergent high pressure system associated with the area of maximum convection. At low levels, the winds, particularly at Manaus, show an annual cycle linked to the meridional displacement of the equatorial trough and its accompanying area of maximum convection (upper level high pressure system). On the average, the precipitable water (Pw) is greater at Manaus than at Belem. Evidence is presented indicating that this is not always the case and that considerable diurnal variation in Pw exists at each station. Mean monthly vertical motions are calculated for the area within the triangle formed with Belem, Manaus and Vilhena as the vertices. These vertical motions show a strong relationship to monthly rainfall totals within the triangle indicating that interannual and monthly rainfall variations may be due to large scale atmospheric circulation changes. Author

N80-33051# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MESOSPHERIC WINDS FROM LIDAR OBSERVATIONS OF ATMOSPHERIC SODIUM

B. R. Clemesha, V. W. J. H. Kirchhoff, D. M. Simonich, and P. P. Batista Jun. 1980 14 p refs Submitted for publication Sponsored by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1811-RPE/179) Avail: NTIS HC A02/MF A01

Laser radar observations of the atmospheric sodium layer made by various groups of workers during the past decade show that the layer exhibits considerable time varying structure. Horizontally spaced measurements of this structure, and use of the results of these observations to derive horizontal velocities in the height range 82 to 99 km are described. The measurements were made with a steerable lidar operating at a fixed zenith angle of 20.9 deg and pointed at each of three azimuths in turn, the complete sequence taking five minutes. The azimuths were chosen such that the intersections of the lidar beam with the sodium layer formed a triangle with approximately 60 km sides. The velocities calculated from the derived time shifts were found to vary with height in an oscillatory manner, with amplitude increasing with height. The E-W component showed a vertical wavelength of approximately 10 km, the N-S component a wavelength of 5 km, and the magnitude of the velocity varied between 6 and 146 m/sec. Author

N80-33052# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

VERTICAL VELOCITY FORCED BY TOPOGRAPHY IN THE SOUTHERN HEMISPHERE

Rubens Leite Vianello (Univ. Federal de Vicosa, Brazil) and V. Brahmananda Rao Mar. 1980 16 p refs Submitted for publication Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1691-RPE/119) Avail: NTIS HC A02/MF A01

Vertical component of wind forced topography in the Southern Hemisphere is calculated using the equation given by Saltzman and Irsch. The contributions of zonal deviations of wind and zonal mean are contained in the equation. The vertical velocity, forced by topography in the Southern Hemisphere is comparable to that in the Northern Hemisphere. In the Northern Hemisphere, the zonal deviations of wind contribute significantly to the vertical velocity. R.K.G.

N80-33053# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WORKSHOP ON DROUGHT FORECASTING FOR NORTH-EAST BRAZIL

Joseph Smagorinsky (NOAA, Princeton, N.J.), Herbert Riehl (Cooperative Inst. for Research in Environmental Sciences), Jagadish Shukla, James Rasmussen (WMO, Geneva), John O. Roads (Scripps Inst. of Oceanography, La Jolla, Calif.), Stefan Hastenrath (Wisconsin Univ., Madison), and William M. Gray (Colorado State Univ., Fort Collins) Sao Jose dos Campos, Brazil Inst. de Pesquisas Espaciais May 1980 69 p refs Workshop held in Sao Jose dos Campos, Brazil, 11-15 Feb. 1980; sponsored in part by the Programa de Tropico Semi-Arido
(INPE-1750-RPE/143) Avail: NTIS HC A04/MF A01

Precipitation forecasting parameters for northeast Brazil were developed. Hydrological, sociological, and economic aspects were examined. A drought forecasting model is presented. T.M.

N80-33054*# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.

RELATION BETWEEN WEST COASTAL RAINFALL AND NIMBUS-6 SCAMS LIQUID WATER DATA OVER THE NORTHEASTERN PACIFIC OCEAN Final Report, Mar. 1978 - Jan. 1979

W. Viezee and H. Shigeishi Jan. 1979 21 p refs Presented at the 4th NASA Weather and Climate Program Sci. Rev., Greenbelt, Md., 24-25 Jan. 1979
(Contract NAS5-24450)
(NASA-CR-160031; Rept-7273) Avail: NTIS HC A02/MF A01 CSCL 04B

The application to rainfall prediction of cloud liquid water data obtained from the SCAMS experiment of Nimbus-6 is explored. The study area is the Pacific Northwest coast of the United States, where rainfall is produced by extratropical storms that approach from across the Pacific Ocean. The SCAMS data related to cloud liquid water over the ocean, and coastal rainfall data, are analyzed for 20 different storm systems in the northeastern Pacific Ocean; these produced significant rainfall from Washington to central California during the period October 1975 through March 1976. Results show that the distribution of storm cloud water analyzed from the SCAMS data over the ocean foreshadows the distribution of coastal rainfall accumulated from the storm at a later time. It is concluded that passive microwave sensor measurements of cloud water over the ocean, when used in conjunction with numerical and other objective guidance, can be used to enhance the accuracy of predictions of coastal rainfall distribution. Limitations in the SCAMS measurements and in the data analysis and interpretation are noted. J.M.S.

N80-33055*# ITT Aerospace/Optical Div., Fort Wayne, Ind.

HIGH RESOLUTION INFRARED RADIATION SOUNDER/MOD 2 (HIRS/2) Final Project Report, 1976 - 1979

Edward W. Koenig et al Aug. 1979 41 p refs
(Contract NAS5-23587)
(NASA-CR-160030) Avail: NTIS HC A03/MF A01 CSCL 04B

The HIRS/2 is provided for the TIROS-N series of operational meteorological satellites. The instrument features 20 spectral channels, including visible (.7 micron), shortwave (3.7 to 4.6 micron), and longwave (6.7 to 15 micron). Radiance data aids determination of vertical temperature profiles, water vapor, and ozone distribution. System performance and test results are described. J.M.S.

N80-33056*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Space Dept.

MULTI-YEAR SLANT PATH RAIN FADE STATISTICS AT 28.56 AND 19.04 GHz FOR WALLOPS ISLAND, VIRGINIA

Julius Goldhirsh Dec. 1979 51 p refs
(NASA Order S-50748-A)
(NASA-CR-160027; APL/JHU-S1R79U-035) Avail: NTIS HC A04/MF A01 CSCL 04B

Multiyear rain fade statistics at 28.56 GHz and 19.04 GHz were compiled for the region of Wallops Island, Virginia covering

the time periods, 1 April 1977 through 31 March 1978, and 1 September 1978 through 31 August 1979. The 28.56 GHz attenuations were derived by monitoring the beacon signals from the COMSTAR geosynchronous satellite, D sub 2 during the first year, and satellite, D sub 3, during the second year. Although 19.04 GHz beacons exist aboard these satellites, statistics at this frequency were predicted using the 28 GHz fade data, the measured rain rate distribution, and effective path length concepts. The prediction method used was tested against radar derived fade distributions and excellent comparisons were noted. For example, the rms deviations between the predicted and test distributions were less than or equal to 0.2dB or 4% at 19.04 GHz. The average ratio between the 28.56 GHz and 19.04 GHz fades were also derived for equal percentages of time resulting in a factor of 2.1 with a .05 standard deviation.
Author

N80-33057*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WEATHER AND CLIMATE NEEDS FOR LIDAR OBSERVATIONS FROM SPACE AND CONCEPTS FOR THEIR REALIZATION
David Atlas and C. Lawrence Korb Jun. 1980 55 p refs Presented at the OSA Conf. on Coherent Laser Radar for Atmospheric Sensing, Aspen, Colo., 15-17 Jul. 1980 Submitted for publication
(NASA-TM-82006) Avail: NTIS HC A04/MF A01 CSCL 04B

The spectrum of weather and climate needs for Lidar observations from space is discussed with emphasis on the requirements for wind, temperature, moisture, and pressure data. It is shown that winds are required to realistically depict all atmospheric scales in the tropics and the smaller scales at higher latitudes, where both temperature and wind profiles are necessary. The need for means to estimate air-sea exchanges of sensible and latent heat also is noted. A concept for achieving this through a combination of Lidar cloud top heights and IR cloud top temperatures of cloud streets formed during cold air outbreaks over the warmer ocean is outlined. Recent theoretical feasibility studies concerning the profiling of temperatures, pressure, and humidity by differential absorption Lidar (DIAL) from space and expected accuracies are reviewed. An alternative approach to Doppler Lidar wind measurements also is presented. The concept involves the measurement of the displacement of the aerosol backscatter pattern, at constant heights, between two successive scans of the same area, one ahead of the spacecraft and the other behind it a few minutes later. Finally, an integrated space Lidar system capable of measuring temperature, pressure, humidity, and winds which combines the DIAL methods with the aerosol pattern displacement concept is described. J.M.S.

N80-33058# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
QUANTITATIVE PRECIPITATION FORECASTS [PREVISAO QUANTITATIVA DE PRECIPITACAO]
Luiz Carlos Baldicero Molion and Eduardo Engel Jun. 1980 19 p refs In PORTUGUESE; ENGLISH summary Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980 Submitted for publication
(INPE-1809-RPE/1977) Avail: NTIS HC A02/MF A01

The forecast of the amount of rain to be produced by synoptic or convective weather system was developed. A review of methods used for (Quantitative Precipitation Forecast), including those which employ numerical weather prediction models, meteorological satellite imagery and radar echoes is presented. An outlook of Brazil's position in this field and an alternative for establishing an operational QPF in the country, with the actual resources are also discussed. T.M.

N80-33059# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) MONTEREY FAA, MONTEREY, CALIFORNIA,. PARTS A, C-F Final Report
24 Jul. 1980 395 p
(AD-A087826; USAFETAC/DS-80/066) Avail: NTIS HC A17/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Monterey FAA, Monterey, CA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface Winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33060# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MCCHORD AFB, WASHINGTON. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
20 Jun. 1980 432 p
(AD-A087812; USAFETAC/DS-80/052) Avail: NTIS HC A19/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for McChord AFB, WA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33061# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MISAWA AB, JAPAN. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-E Final Report
3 Jul. 1980 396 p
(AD-A087824; USAFETAC/DS-80/064) Avail: NTIS HC A17/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Misawa AB, JP. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet bulb temperature depression versus dry bulb temperature, means and standard deviations of dry bulb, wet bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33062# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
LORING AFB, CARIBOU, MAINE. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
27 Jun. 1980 479 p
(AD-A087823; USAFETAC/DS-80/063) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Loring AFB, Caribou, Maine. It contains the following parts: (1) weather conditions; atmospheric phenomena; (2) precipitation, snowfall and snow depth (daily amounts and extreme values); (3) surface winds; (4) ceiling versus visibility; sky cover; (5) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum

temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (6) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33063# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

KINGSLEY FIELD, KLAMATH FALLS, OREGON. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO). PARTS A-F Final Report

16 Jul. 1980 456 p

(AD-A087825; USAFETAC/DS-80/065) Avail: NTIS HC A20/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Kingsley Field, Klamath Falls, Oregon. It contains the following parts: (1) weather conditions; atmospheric phenomena; (2) precipitation, snowfall and snow depth (daily amounts and extreme values); (3) surface winds; (4) ceiling versus visibility; sky cover; (5) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (6) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-33064# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

DEVELOPMENT OF TECHNIQUES TO SPECIFY CLOUDINESS AND RAINFALL RATE USING GOES IMAGERY DATA Final Report

Stuart H. Muench and Thomas J. Keegan Oct. 1979 46 p refs

(AF Proj. 6670)

(AD-A084757; AFGL-TR-79-0255; AFGL-ERP-687) Avail: NTIS HC A03/MF A01 CSCL 04/2

Methods of introducing digitized satellite imagery into short range, objective forecasting operations are presented. The data archive being assembled for this study is described, with particular attention given to the steps taken to maximize the accuracy of the satellite imagery. These steps included fine tuning the navigation and selecting procedures for normalizing the data by correcting for the effects of Lambertian and anisotropic scattering. Consistency of the data, spatial and temporal, was tested by analysis of ground reflectance during cloudless days, and a pilot test of the specification of single layers of clouds was conducted. Both of these tests gave envouraging results. An investigation of specifying precipitation rate, using just the visible reflectance and infrared temperature of the cloud top, also produced good results. Author

N80-33065# Federal Aviation Administration, Atlantic City, N.J.

THE EFFECT OF THE WESTERN UNION WEATHER DATA SYSTEM ON THE PREFLIGHT BRIEFING POSITION AT THE CHICAGO FLIGHT SERVICE STATION Final Report, Aug. 1975 - May 1978

Ephraim Shochet, James D. Talotta, and Robert P. Holladay Jul. 1980 29 p ref

(AD-A088415; FAA-CT-79-55; FAA-RD-80-23) Avail: NTIS HC A03/MF A01 CSCL 17/7

An experiment utilizing a 'before/after' research design was conducted to determine the effect of the Western Union Weather Data System (WDS) on the preflight briefing position at the Chicago, Illinois, Flight Service Station (FSS). Specialist activity was recorded by making written annotations on a moving paper chart called a kymograph. The average length of time spent in each activity prior to the installation of automated equipment was compared to the time spent in the same activity after automation. In addition, a questionnaire survey and personal interviews with specialists were conducted in the 'after' period. The data obtained from the specialist opinion survey indicate that the WDS improved the quality of flight information service to the user pilot and improved job satisfaction for the specialist. The objective data was congruent with and in the same direction as the data that was obtained from the specialist opinion survey. However, the specialists perceived a greater reduction in workload than was measured in the before and after comparison of preflight briefing times. GRA

N80-33066# Maryland Univ., College Park. Dept. of Meteorology.

THE MICROCLIMATE OF A TROPICAL EVERGREEN FOREST Preliminary Final Report, 15 Jul. 1976 - 31 Dec. 1979

R. T. Pinker and O. E. Thompson Aug. 1980 101 p refs

(Grant DAAG29-76-G-0292)

(AD-A088059; ARO-13660.4-GS) Avail: NTIS HC A06/MF A01 CSCL 04/2

Selected results of a three year project to study the climatological and micrometeorological conditions in a tropical evergreen forest, are summarized in this report. The forest area under study is in the interior of Thailand and is influenced by a cool, dry northeast monsoonal flow in the winter and a warm, moist southwest monsoonal flow in the summer. Information collected during a three year field program included ground stations temperature, relative humidity, precipitation, evaporation, hours of sunshine and tower measurements of temperature, dew point temperature, wind velocity, incoming and reflected solar radiation, incoming and outgoing infrared radiation, spectral radiation and sub-surface temperature profiles in the forest and in a cleared area within the forest. GRA

N80-33067# Naval Research Lab., Washington, D. C.

NUMERICAL SIMULATION OF THE INFLUENCE OF SEA-SURFACE TEMPERATURE ON TRANSLATING TROPICAL CYCLONES Interim Report

Simon W. Chang and Rangarao V. Madala 17 Jul. 1980 46 p refs

(AD-A088050; NRL-MR-4272) Avail: NTIS HC A03/MF A01 CSCL 04/2

A three dimensional numerical model with a domain of 3000 x 3000 km is used to study the influence of sea-surface temperature (SST) on the behavior of tropical cyclones translating with mean flows in the Northern Hemisphere. We find that tropical cyclones tend to move into regions of warmer SST when a gradient of SST is perpendicular to the mean ambient flow vector (MAFV). The model results also indicated that a region of warmer SST situated to the right side of the MAFV is more favorable for storm intensification than to the left side due to the asymmetries in air-sea energy exchanges associated with translating tropical cyclones. The model tropical cyclone intensifies and has greater rightward deflection in its path relative to the MAFV when translating into the region of warmer SST. The model tropical cyclone intensifies when its center travels along a warm strip, it weakens along, but does not move away from a cool strip. The results suggest that the SST distribution not only affects the intensity and path of tropical cyclones frictionally, but also affects them thermally through processes of heating redistribution and geostrophic adjustment. GRA

N80-33068# Naval Research Lab., Washington, D. C. Environmental Sciences Div.

PASSIVE 19.3 GHz RADIOMETER AND AEROSOL DATA FROM THE NORTH SEA DURING MARSEN I, SEPTEMBER - OCTOBER 1979 Interim Report

S. G. Gathman and B. G. Julian 13 Aug. 1980 116 p refs

(AD-A088229; NRL-MR-4285) Avail: NTIS HC A06/MF A01 CSCL 04/2

The production and distribution of the various aerosols which are a result of air sea interactions were investigated. The mechanism of maritime aerosol generation was examined and the utility of satellite derived data on sea properties were analyzed. R.C.T.

N80-33069# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

ATLAS OF CLOUD-FREE LINE-OF-SIGHT PROBABILITIES. PART 5: NORTH AFRICA AND THE MIDDLE EAST Interim Report

Iver A. Lund, Donald D. Grantham, Eugene A. Bertoni, and Clarence B. Elam, Jr. (Environmental Technical Applications Center, Scott AFB, Ill.) 9 Nov. 1979 67 p refs
(AF Proj. 6670)
(AD-A088156; AFGL-TR-79-0275-Pt-5; AFGL-AFSG-417)
Avail: NTIS HC A04/MF A01 CSCL 04/2

This is the fifth part of a planned Northern Hemisphere atlas of probabilities of cloud free lines-of-sight between the Earth and space. The probabilities are for the mid-season months: January, April, July, and October; four times of day: 0000-0200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and three elevation angles: 10, 30 and 90 deg. Parts 1, 2, 3, and 4 depicted cloud free line-of-sight probabilities for Germany, the USSR, the USA, and Europe, respectively.
GRA

N80-33070# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
USE OF HELIUM-3 AS A GAS TRACER FOR MESO-SCALE METEOROLOGICAL STUDIES
J. E. Halverson, M. M. Pendergast, and A. L. Boni 1979 24 p refs Presented at the Atmospheric Tracer Workshop, Los Alamos, N. Mex., 23-24 May 1979
(Contract EY-76-C-09-0001)
(DP-MS-79-51) Avail: NTIS HC A02/MF A01

Plans to use He-3 as a tracer in atmospheric diffusion studies are outlined. A specially designed static gas mass spectrometer is used to measure He-3/He-4 abundance ratios in the atmospheric samples. Analysis of results of previous studies indicate that He-3 can be a useful tracer for plume releases at distances greater than 100 km.
DOE

N80-33071# Los Alamos Scientific Lab., N. Mex.
COMPARISON OF ATMOSPHERIC TEMPERATURE STRUCTURE AT THE WALL AND IN THE MIDDLE OF A VALLEY
Sumner Barr, Williams E. Clements, and S. Kerry Wilson 1980 5 p refs Presented at the 2nd Joint Conf. on Appl. of Air Pollution Meteorol., Am. Meteorol. Soc., New Orleans, 24-27 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-792; CONF-800327-7) Avail: NTIS HC A02/MF A01

At Anderson Creek Valley in the Geysers area of California, temperatures on the valley wall were compared with temperature profiles in the middle of the valley. An ensemble of temperature measurements including vertical soundings and surface based measurements from fixed stations and a mobile unit were analyzed. Surface measurements at various altitudes in Anderson Creek Valley were as much as 10 C cooler than the temperature in mid valley at the same altitude. The departures were smallest in the early evening and grew during the night. The cold air was quite shallow and if care were taken to make ground based measurements on promontaries or towers, the gross stability could be characterized by surface temperature observations up the side of the valley. A more promising analysis of the data is to interpret the thermal gradients from the valley wall to the center in terms of the driving force they provide to the drainage flow.
DOE

N80-33072# Battelle Pacific Northwest Labs., Richland, Wash.
DEFINITION OF GUST MODEL CONCEPT AND REVIEW OF GUST MODELS
David C. Powell and James R. Connell Jun. 1980 100 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3138) Avail: NTIS HC A05/MF A01

Four models are examined which attempt to describe wind fluctuations in relation to a wind energy conversion system that is subjected to these fluctuations observed from a fixed location within the atmospheric boundary layer. The primary purpose of this examination is to provide a basis for understanding present and future developments in gust and gust rise models. The examination is accomplished by identifying the gust definitions used in the models and relating them to a basic definition given.
DOE

N80-33073# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS PROGRAM ELEMENT Annual Report, Jul. 1978 - Sep. 1979
L. L. Wendell, W. R. Barchet, J. R. Connell, A. H. Miller, W. T. Pennell, and D. S. Renne May 1980 209 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3211) Avail: NTIS HC A10/MF A01

As a service element within the Federal Wind Energy Program, the wind characteristics program element (WCPE) is established to provide the appropriate wind characteristics information to those involved in: the design and evaluation of wind energy conversion systems (WECS); energy program planning; selecting sites for WECS installation; and the operation of WECS. To effectively produce the information needed in these four categories, the WCPE, for which the Pacific Northwest Laboratory (PNL) has the responsibility for management and technical assistance, was divided into four technical program areas. During this reporting period PNL was also assigned the management responsibility for the data collection at the US Department of Energy's (DOE's) candidate sites, as well as the task of providing technical assistance to DOE evaluation and site selection panels for new candidate sites.
DOE

N80-33074# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF A PHOTODIODE-ARRAY OPTICAL TURBULENCE SENSOR TO WIND STUDIES IN COMPLEX TERRAIN
W. M. Porch and T. J. Green 1980 17 p refs Presented at ASCOT Program Planning Meeting, Gettysburg, Pa., 15 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-84503; CONF-800480-3) Avail: NTIS HC A02/MF A01

A digital photodiode array optical turbulence sensor was used to gather data simultaneously with analog optical anemometer measurements during the July 1979 ASCOT experiment. This system provided useful information regarding the uniformity of optical turbulence used by the optical anemometer to drive cross path wind speeds. Wind speeds derived from digital analysis of the photodiode array intensities also provided an independent measure of the cross path wind speed. Close agreement was found between these two measures of the wind.
DOE

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-33075# Woods Hole Oceanographic Institution, Mass.
REMOTE ACOUSTIC SENSING OF OCEANIC FLUID AND BIOLOGICAL PROCESSES
M. H. Orr Jun. 1980 57 p refs Presented at the Ocean Acoustic Remote Sensing Workshop, Seattle, 21-25 Jan. 1980
(Contract N00014-77-C-0196; Grants NOAA-NA79-AA-D-00030; NOAA-NA79-AA-D-00102; NSF OCE-77-08682; NR Proj. 083-004)
(AD-A087665; WHOI-80-2; WHOI-Contrib-4559) Avail: NTIS HC A04/MF A01 CSCL 08/1

High frequency acoustic backscattering systems are being used in monostatic modes to evaluate the use of acoustic techniques to detect and study a variety of fluid processes in the oceanic environment. A short outline of those research programs actively evaluating and using acoustic techniques is presented, followed by a detailed review of this investigator's program. This program uses a multifrequency high frequency acoustic system to study a variety of processes including turbulent mixing, air-sea interactions internal waves, interleaving water masses, natural particulate dispersion and distribution, the dispersion of particulates associated with deep ocean disposal of industrial chemical waste, and biological response to a variety of stimulae including fluid motion, predators, and oceanographic instrumentation. Graphic acoustic data records of several of the above phenomena are described.
GRA

N80-33076# Naval Research Lab., Washington, D. C. Space Systems Div.
ON THE INFERENCE OF OCEANIC CURRENTS OR EDDIES BY SPACEBORNE ALTIMETRY THROUGH THE DYNAMIC METHOD FOR THE DETERMINATION OF THREE DIMENSIONAL DENSITY (TEMPERATURE) FIELD Progress Report
Davidson T. Chen and Vincent E. Noble 18 Jul. 1980 33 p refs
(W05270S00)
(AD-A088082; NRL-MR-4273) Avail: NTIS HC A03/MF A01 CSCL 08/3

The physical theoretical background, the mathematical governing equations, the absolute error, and the relative error of the dynamic method used in inferring the geostrophic current and eddy systems from the spaceborne altimeter-sensed measurements of dynamic heights or slopes have been laboriously developed. Also, the conditions for the determination of the three dimensional density (temperature) field uniquely are mentioned and explained. The space-borne altimeter is shown to be the instrument for the provision of one condition, i.e., the ocean surface current condition. The three dimensional density (temperature) field and its boundary conditions at the air-sea interface play dominant roles in the weather prediction and the undersea technology. The interchangeable use of the terms of density and temperature fields is valid only when the salinity can be assumed as constant. GRA

N80-33077# Texas A&M Univ., College Station. Dept. of Oceanography.
THE GULF STREAM MEANDERS EXPERIMENT: CURRENT METER, ATMOSPHERIC, AND SEA LEVEL DATA REPORT FOR THE MOORING PERIOD Data Report, Jan. - May 1979
David A. Brooks, John M. Bane, Robert L. Cohen, and Paul Blankinship (North Carolina State Univ. at Raleigh) Jul. 1980 277 p refs Prepared in cooperation with North Carolina Univ. at Chapel Hill
(Contract N00014-77-C-0354; Grant NSF OCE-79-06710)
(AD-A088069; TAMU-REF-80-7-T) Avail: NTIS HC A13/MF A01 CSCL 08/3

The principal objective of the Gulf Stream Meanders experiment was to kinematically and dynamically describe the nature of meanders. The upper continental slope region off Onslow Bay, North Carolina was chosen for the experiment site because several previous investigations in that area provided a baseline data set giving some ideas about time and space variability scales within and a several month mean view of the stream. In addition, earlier observations ranging from reports in centuries-old ship logs to recent satellite infrared imagery made it apparent that Gulf Stream meandering was more intense between Charleston and Cape Hatteras than elsewhere in the South Atlantic Bight. Current, sea level, and atmospheric data from the Gulf Stream region off North Carolina for the period January - May 1979 are documented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-33078# Cornell Univ., Ithaca, N. Y. Biology and Biophysics Dept.
STRUCTURE AND FUNCTION IN PHOTOSYNTHETIC MEMBRANES AND THEIR COMPONENTS Annual Progress Report, 1 Dec. 1978 - 30 Nov. 1979
Roderick K. Clayton 1979 16 p refs
(Contract EY-76-S-02-3162)
(COO-3162-51) Avail: NTIS HC A02/MF A01

Structure and function are being studied in photosynthetic membranes and their components, principally with Rhodopseudomonas sphaeroides. That bacteriochlorophyll (Bchl) can have a strongly shifted absorption maximum in the membrane, without the involvement of excitonic Bchl-Bchl interactions was demonstrated. The orientations of pigments in the membrane are being determined, and the orientations of four distinguishable carotenoid components are under investigation. These studies provide data for computations of energy transfer and electron tunneling, and may bear on the mechanism of the electrogenic shifts of the absorption bands of carotenoids. Complexities in the absorption spectra of cytochromes were discovered, and data concerning the distribution of carotenoids between antenna and reaction centers (RCs) in the membrane were found. A corrected interpretation of the action of orthophenanthroline as an inhibitor of electron transport was presented. Some theoretical studies of the problems that may arise in constructing solar cells from natural or artificial RCs were conducted. DOE

N80-33079# Food and Drug Administration, Silver Spring, Md. Bureau of Medical Devices.
RADIOFREQUENCY LESION GENERATORS, A PROBLEM DEFINITION STUDY Final Report
Michael S. Gluck 2 Jun. 1980 50 p refs
(PB80-191844; FDA/BMD-80/75) Avail: NTIS HC A03/MF A01 CSCL 06L

The development of a safety and performance standard for radiofrequency lesion generators is discussed. A review is provided of the available literature and manufacturers' data. Problems associated with radiofrequency lesion generators are identified, and requirements for inclusion in a standard to address these problems are recommended. An annotated bibliography is included. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-33080# Monsanto Research Corp., Dayton, Ohio.
DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR TOXICOKINETIC RESEARCH Final Report, 1 May 1978 - 30 Sep. 1979
M. K. Hershey, P. L. Sherman, and J. V. Pustinger Wright-Patterson AFB, Ohio Aerospace Medical Research Lab. Oct. 1979 39 p refs
(Contract F33615-78-C-0515)
(AD-A077729; MRC-DA-906; AMRL-TR-79-89) Avail: NTIS HC A03/MF A01 CSCL 06/16

Methods developed for the analysis of monomethylhydrazine (MMH) and its metabolites in the urine and blood of laboratory rats which had been injected with MMH at concentrations of 7.5 mg/kg and 15 mg/kg are described. Modifications of this method to analyze for free MMH in urine and blood of human origin are also discussed. S.F.

N80-33081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POCKET ECG ELECTRODE Patent Application
Gordon F. Lund, inventor (to NASA) (NAS-NRC, Washington, D.C.) Filed 11 Sep. 1980 14 p Sponsored by NASA
(NASA-Case-ARC-11258-1; US-Patent-Appl-SN-185865) Avail: NTIS HC A02/MF A01 CSCL 06B

A low noise electrode suited for sensing electrocardiograms when chronically and subcutaneously implanted in a free ranging subject is described. The electrode comprises a pocket shaped electrically conductive member with a single entrance adapted to receive body fluids. The exterior of the member and the entrance region is coated with electrical insulation so that the only electrolyte/electrode interface is within the member, remote from artifact-generating tissue. Cloth straps are bonded to the member to permit the electrode to be sutured to tissue and to provide electrical lead flexure relief. NASA

N80-33082*# Technology, Inc., Houston, Tex. Life Sciences Div.
A MICROPROCESSOR-BASED CARDIOTACHOMETER Final Report
John A. Donaldson and William G. Crosier 31 Oct. 1979 92 p
(Contract NAS9-14880)
(NASA-CR-160607) Avail: NTIS HC A05/MF A01 CSCL 06B

The development of a highly accurate and reliable cardiotach-

ometer for measuring the heart rate of test subjects is discussed. It measures heart rate over the range of 30 to 250 beats/minute and gives instantaneous (beat to beat) updates on the system output so that occasional noise artifacts or ectopic beats could be more easily identified except that occasional missed beats caused by switching ECG leads should not cause a change in the output. The cardiotachometer uses an improved analog filter and R-wave detector and an Intel 8080A microprocessor to handle all of the logic and arithmetic necessary. By using the microprocessor, future hardware modifications could easily be made if functional changes were needed. R.K.G.

N80-33083*# Technology, Inc., Houston, Tex. Life Sciences Div.

CARDIOPULMONARY DATA ACQUISITION SYSTEM. VERSION 2.0, VOLUME 1: USER'S GUIDE Final Report

17 Dec. 1979 75 p

(Contract NAS9-14880)

(NASA-CR-160608) Avail: NTIS HC A04/MF A01 CSCL 05B

The Cardiopulmonary Data Acquisition System is a computerized method of both collecting and analyzing physiological data on subjects during a treadmill or ergometer stress test in the clinic. The real time acquisition of the physiological data, such as, heart rate, blood pressure, work load, and respiratory gases is accomplished by an LSI-11 microcomputer which displays this data on a hard copy terminal. The data are also concurrently stored on a mass storage device and anytime after the test period a selectable number of copies of the plots or minute reports can be reproduced at the terminal. R.K.G.

N80-33084*# Technology, Inc., Houston, Tex. Life Sciences Div.

CARDIOPULMONARY DATA ACQUISITION SYSTEM. VERSION 2.0, VOLUME 2: DETAILED SOFTWARE/HARDWARE DOCUMENTATION Final Report

18 Feb. 1980 195 p

(Contract NAS9-14880)

(NASA-CR-160609) Avail: NTIS HC A09/MF A01 CSCL 05B

Detailed software and hardware documentation for the Cardiopulmonary Data Acquisition System is presented. General wiring and timing diagrams are given including those for the LSI-11 computer control panel and interface cables. Flowcharts and complete listings of system programs are provided along with the format of the floppy disk file. M.G.

N80-33085*# Tennessee Univ., Knoxville. Dept. of Medical Biology.

CHANGES IN ERYTHROPOIETIN LEVELS DURING SPACE FLIGHT OR SPACE FLIGHT SIMULATION Final Technical Report

C. D. R. Dunn and J. P. Hen Jul. 1980 8 p refs

(Contract NAS9-15164)

(NASA-CR-163591) Avail: NTIS HC A02/MF A01 CSCL 06P

Two hundred and seventy samples from 24 subjects involved in 3 bedrest studies and from 3 subjects involved in Spacelab Mission Development Test 3 were assayed for erythropoietin (Ep), in an in vitro fetal mouse liver cell assay, and for ferritin using a commercially available immunoradiometric assay kit. No trends or significant changes in serum Ep were observed. Serum ferritin concentrations tended to increases slightly during the 'missions', reflecting a redirection of iron from the suppressed erythron into iron stores. T.M.

N80-33086*# Webb Associates, Yellow Springs, Ohio.

THE DEVELOPMENT OF AN ELASTIC REVERSE GRADIENT GARMENT TO BE USED AS A COUNTERMEASURE FOR CARDIOVASCULAR DECONDITIONING

James F. Annis and Paul Webb [1980] 69 p refs

(Contract NAS2-7156)

(NASA-CR-152379) Avail: NTIS HC A04/MF A01 CSCL 06P

Using a new nomex lycra elastic fabric and individualized garment engineering techniques, reverse gradient garments (RGG's) were designed, constructed, and tested for effectiveness as a countermeasure against cardiovascular deconditioning. By combining torso compensated positive pressure breathing with a distally diminishing gradient of counterpressure supplied by the elastic fabric on the limbs, the RGG acts to pool blood in the extremities of recumbent persons much as though they were standing erect in 1 g. The RGG stresses the vasculature in a fashion similar to that experienced by the normally active man, hence preventing or limiting the development of post weightlessness orthostatic intolerance and related conditions. Four male, college age subjects received daily treatments with the RGG during a 15 day bedrest study. Four additional subjects also underwent the bedrest, but received no treatments; they served as controls. The preliminary indication was that the RGG was somewhat effective in limiting the deconditioning process. R.K.G.

N80-33087# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic and Bioengineering Div.

A TECHNIQUE FOR THE INJECTION OF RADIOACTIVE TRACER MICROSPHERES DURING ACCELERATION STRESS

Kevin J. Greenless, Clarence M. Oloff, Willi J. Bushring, and Katharine C. Smith Jun. 1980 17 p refs

(AF Proj. 7222; AF Proj. 6893)

(AD-A087931; AMRL-TR-78-114) Avail: NTIS HC A02/MF A01 CSCL 14/2

A microsphere injection system is presented which allows the remote sequential injection of as many as five separately labeled radioactive tracer microspheres while under acceleration stress. Cinemicroscopic observation of the injected microsphere suspension showed little or no microsphere aggregation. Statistical analysis of the microsphere injections on the basis of counts per minute showed 90 - 5.7% of the injection was delivered during three gravities of acceleration. No significant difference in percent injectate delivered was found among the five cartridges. Subjection of the microsphere injection system to 12 G acceleration did not impair proper sequencing or delivery of test solutions. GRA

N80-33088# Southwest Research Inst., San Antonio, Tex.

PRELIMINARY STUDY OF THE BEHAVIORAL AND BIOLOGICAL EFFECTS OF HIGH INTENSITY 60 Hz ELECTRIC FIELDS Interim Technical Progress Report

Charles S. Feldstone, Ronald J. Spiegel, Wendell Winters, and James J. Polonis 1 Mar. 1980 119 p refs

(Contract ET-78-C-01-2875)

(SWRI-14-5277; ITPR-4) Avail: NTIS HC A06/MF A01

Progress is reported in studies of the effects of high intensity 60 Hz electric fields on baboon behavior, both individual performance and natural behavior. The result of the study should be either a clear indication of the electric field intensity which produces deleterious effects in the baboon or an indication that the highest field intensity of practical interest produces no deleterious effects. The generalization of results to man will be further aided by the development of models relating the physical effects of electric fields on man to the physical effects on the baboon. DOE

N80-33089# Pittsburgh Univ., Pa.

EVALUATION OF CARBON MONOXIDE IN BLOOD SAMPLES FROM THE SECOND NATIONAL HEALTH AND NUTRITION SURVEY Progress Report, 1 Apr. 1979 - 1 Apr. 1980

Edward P. Radford 1980 20 p refs

(Contract DE-AC02-77EV-04552)

(COO-4552-2) Avail: NTIS HC A02/MF A01

Progress on research into the epidemiology of CO is reported. Carbon monoxide levels in blood were determined from 8052 samples. The magnitude of the impact of environmental sources distinct from smoking is evaluted. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-33090*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

PROCRU: A MODEL FOR ANALYZING CREW PROCEDURES IN APPROACH TO LANDING **Interim Report**
S. Baron, R. Muralidharan, R. Lancraft, and G. Zacharias Apr. 1980 223 p refs
(Contract NAS2-10035)
(NASA-CR-152397; BBN-4374) Avail: NTIS HC A10/MF A01 CSCL 05E

A model for analyzing crew procedures in approach to landing is developed. The model employs the information processing structure used in the optimal control model and in recent models for monitoring and failure detection. Mechanisms are added to this basic structure to model crew decision making in this multi task environment. Decisions are based on probability assessments and potential mission impact (or gain). Sub models for procedural activities are included. The model distinguishes among external visual, instrument visual, and auditory sources of information. The external visual scene perception models incorporate limitations in obtaining information. The auditory information channel contains a buffer to allow for storage in memory until that information can be processed. S.F.

N80-33091# Boeing Aerospace Co., Seattle, Wash. Data Processing Technology.
PSYCHOPHYSICAL CRITERIA FOR VISUAL SIMULATION SYSTEMS. PHASE 2: EXPERIMENTAL INVESTIGATIONS OF DISPLAY JOINTS AND SCENE INSERTS **Final Report**
Conrad L. Kraft and Charles D. Anderson Aug. 1980 81 p refs
(Contract F33615-78-C-0012; AF Proj. 6114)
(AD-A088316; AFHRL-TR-80-18) Avail: NTIS HC A05/MF A01 CSCL 05/10

This report describes the approach, procedures, and results of two psychophysical experiments to provide data useful in developing design criteria for visual simulation systems. The first dealt with the influence of the width of joints between display channels on the discrimination of vertical and rotational scene misalignment across the joint. The resulting information indicated that increasing amounts of rotation resulted in an increased percentage of correct detections. This anticipated result was not found for the displacement conditions. It was hypothesized that this unexpected result may have been caused by the counteracting effect of the Poggendorff visual illusion. The second psychophysical experiment dealt with the discrimination of rotational misalignment of scene inserts. Increasing insert size and increasing rotational misalignment produced increased detection performance. The 50% detection threshold occurring at 7 arc seconds of displacement between corresponding portions of the insert and surrounding scenes. Design tolerances based on these data are suggested. GRA

N80-33092# Applied Psychological Services, Wayne, Pa. Science Center.
HUMAN PERFORMANCE IN CONTINUOUS OPERATIONS. VOLUME 3: TECHNICAL DOCUMENTATION **Technical Report, Jan. - Sep. 1979**
Arthur I. Siegel, Mark G. Pfeiffer, Felix Kopstein, J. Jay Wolf, and Halim Orkaptan (ARI, Alexandria, Va.) Mar. 1980 124 p refs
(Contract DAHC19-77-C-0054; DA Proj. 2Q1-63743-A-774)
(AD-A088339; ARI-RP-80-4C-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 05/9

This is the third volume of a series dealing with human performance in continuous operations. This volume documents the technical procedures used to analyze adverse effects and to project diminished human performance capabilities during continuous operations, as described in volumes 1 and 2 of this series. Specifically, the present volume (volume 3 of the set): (1) depicts the technical aspects of the development of the prior two volumes, (2) updates a prior survey of the literature concerning the effects of continuous operations on military performance, (3) describes the methods for deriving 'critical' tasks included in volume 1, (4) describes the details of the mathematical procedures employed in volume 1 to calculate and compound projected performance effectiveness, and (5) describes the details of a computer simulation model, which incorporates human effects, for simulating human performance in continuous operations. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-33093*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
COMPUTER COORDINATION OF LIMB MOTION FOR A THREE-LEGGED WALKING ROBOT
Charles A. Klein and Mark R. Patterson Sep. 1980 108 p refs
(Grant NAG1-30)
(NASA-CR-163566) Avail: NTIS HC A06/MF A01 CSCL 05H

Coordination of the limb motion of a vehicle which could perform assembly and maintenance operations on large structures in space is described. Manipulator kinematics and walking robots are described. The basic control scheme of the robot is described. The control of the individual arms are described. Arm velocities are generally described in Cartesian coordinates. Cartesian velocities are converted to joint velocities using the Jacobian matrix. The calculation of a trajectory for an arm given a sequence of points through which it is to pass is described. The free gait algorithm which controls the lifting and placing of legs for the robot is described. The generation of commanded velocities for the robot, and the implementation of those velocities by the algorithm are discussed. Suggestions for further work in the area of robot legged locomotion are presented. T.M.

N80-33094*# Umpqua Research Co., Myrtle Creek, Ore.
ADVANCED MICROBIAL CHECK VALVE DEVELOPMENT **Final Report**
G. V. Colombo and D. R. Greenley Jun. 1980 34 p
(Contract NAS9-15854)
(NASA-CR-163577) Avail: NTIS HC A03/MF A01 CSCL 06K

A flight certified assembly identified as a Microbial Check Valve (MCV) was developed and tested. The MCV is a canister packed with an iodinated anionic exchange resin. The device is used to destroy organisms in a water stream as the water passes through the device. The device is equally effective for fluid flow in either direction and its primary method of organism removal is killing rather than filtering. The MCV was successfully developed for the space shuttle to: disinfect fuel cell water; and prevent back contamination of the stored potable water supply. One version of the device consists of a high residual iodinated resin bed that imparts approximately 2 ppm of iodine to the fuel cell water as it flows to the potable water tanks. A second version of the device consists of a low residual iodinated resin bed. One of these low residual beds is located at each use port in the potable water system for the dual purpose of removing some iodine from the potable water as it is dispensed and also to prevent back contamination of the potable supply. T.M.

N80-33095# Letterman Army Inst. of Research, San Francisco, Calif. Dept. of Nutrition.
METABOLIC ASPECTS OF CALORIC RESTRICTION (500 CALORIES): BODY COMPOSITION CHANGES
Harry J. Krzywicki, C. Frank Consolazio, Herman L. Johnson, and Norman F. Witt Aug. 1979 27 p refs
(DA Proj. 3A0-25601-A-822)
(AD-A082495; LAIR-73) Avail: NTIS HC A03/MF A01 CSCL 06/5

Body composition changes in 8 healthy adult males were studied while subsisting on a daily liquid diet containing 340 kcal from carbohydrate and 160 kcal from protein for a 10 day period. Half of the subjects (group 1) were denied minerals with the remaining half (group 2) receiving a daily mineral supplement. Body weight losses were severe (5.51 and 4.67 kg) in groups 1 and 2, respectively. This loss was further partitioned into 3.59 kg of fat, 1.4 kg of water, and 0.39 kg of dry protein in

group 1, while group 2 showed losses of 2.76 kg of fat, 1.32 kg of water and 0.39 kg of dry protein. The largest amount of water was lost by the group which was denied minerals. This indicates the water sparing and fat utilizing effects of limited carbohydrate and protein with mineral supplementation. The data indicate that the small quantity of protein in the diet was somewhat beneficial in sparing body protein. E.D.K.

N80-33096# Aeronautical Research Labs., Melbourne (Australia).
A MINIMUM EXCURSION-TIME CONTROL SYSTEM
B. Gromek and T. G. Ryall May 1980 15 p
(AD-A087774; ARL/Struc-TM-312) Copyright. Avail: NTIS HC A02/MF A01 CSCL 14/2

A significant reduction in total test times of computer-controlled fatigue tests has been achieved by the design of a minimum excursion-time control system. The computer calculates in real time the minimum-time path between two excursion points, subject to variable velocity and acceleration constraints. This technique has been extended to multi-channel systems. GRA

N80-33097# Harry Diamond Labs., Adelphi, Md.
THE DESIGN OF A FLUIDIC OXYGEN INTERMITTENT DEMAND FLOW DEVICE
George Mon Mar. 1980 13 p refs
(DA Proj. 1L1-62120-AH-25)
(AD-A084083; HDL-TM-80-14) Avail: NTIS HC A02/MF A01 CSCL 06/12

A laminar flow fluidic intermittent-demand valve for oxygen therapy was designed and tested to faithfully follow a patient's respiratory cycle. A savings of oxygen from 10 to 67 percent is possible under certain conditions. A small air pump can power the fluidic circuit since no moving parts are used other than a diaphragm flow valve, this intermittent-demand valve is expected to be very reliable and require little or no maintenance. Author

N80-33098# Naval Weapons Center, China Lake, Calif. Research Dept.
STUDIES ON THE REMOVAL OF CARBON MONOXIDE FROM THE ATMOSPHERE AT AMBIENT TEMPERTURE Final Report
Dwight A. Fine and Carol A. Heller May 1980 27 p
(Contract N00023-79-WR-9615)
(AD-A085469; NWC-TP-6179) Avail: NTIS HC A03/MF A01 CSCL 04/1

Catalysts of platinum or palladium on carbon or alumina show promise in removing carbon monoxide (CO) from air at room temperature. As much as 80 percent of the CO in a 230 ppm CO/air powder was removed by 1 g of 5 percent palladium on carbon powder in one pass. Catalysts of 0.5 percent metal on alumina pellets showed comparable efficiency, and proved more convenient to handle. Calculation indicate that the CO concentration in 1000 cu ft of air containing 500 ppm CO could be reduced to 200 ppm in 100 minutes using only 180 g (0.4 pound) of 0.5 percent palladium catalyst and an pump moving 10 cu ft per minute of air (one pass of air through catalyst). Solutions of copper 1 in monoethanolamine proved much less efficient due to oxidation problems. S.F.

N80-33099# Boston Coll., Chestnut Hill, Mass.
A TENTATIVE TAXONOMY OF HUMAN INTERACTIVE FACTORS IN AIRCRAFT MISHAPS Final Report, 1 Apr. 1979 - 1 Mar. 1980
Kenneth W. Wegner May 1980 48 p refs
(Grant AF-AFOSR-0102-79; AF Proj. 2313)
(AD-A088442; AFOSR-80-0595TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

Previous research and results of the present study lend support to the concept of developing a taxonomy of factors or causes in aircraft mishaps. Twenty-five years of mishap research related to psychophysiological and environmental factors was reviewd to determine the most frequently occurring variables. Twenty-one of these were identified and classified into a tentative taxonomy under three functions: Equipment - Physical Environment, Management System, and Operator. Sixteen definitions related to these factors were available to analyze for reliability and relationship to the taxonomy functions. A survey form was developed which included the above definitions and nine selected aircraft mishap summaries. This instrument was administered to a Flight Safety Officer School class and a group of naive subjects of equivalent age and years of education. The task to be performed was to rate the presence or absence of these causes in each of the mishap summaries. Data analysis performed included the computation of mean agreement rates, inter-case consistency, intercorrelations of selected variables, and comparison of mean agreement rates and judged clarity of the definitions. GRA

N80-33100# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Human Engineering Section.
A HUMAN ENGINEERING SPECIFICATION FOR LEGIBILITY OF ALPHANUMERIC SYMBOLOGY ON VIDEO MONITOR DISPLAYS
E. L. Gorrell Jun. 1980 28 p refs Revised
(AD-A088470; DCIEM-TR-80-R-26-Rev) Avail: NTIS HC A03/MF A01 CSCL 05/5

Conventional human engineering legibility specifications for alphanumeric symbology displayed on video monitors consist of predictors of user performance derived from legibility research studies. Typical legibility predictors are symbol size, symbol luminance, contrast ratio, font, dot matrix dimensions, and pixel active area. This report discusses a number of significant problems associated with the development and application of conventional legibility specifications. In addition, it presents a detailed specification for comparative and objective evaluation of video monitor legibility performance based upon legibility tests developed for the USAF. This specification consists of criteria for subject selection, visual environment design, display monitor setup, test material design and presentation, legibility task scores, and legibility test performance. It is to be noted that this report is a revision of an earlier report. While the specification for the legibility test has not undergone any major change, the proposed Minimum Conventional Legibility Criteria have been reduced in number. The revised report also includes a new appendix describing in detail a standardized procedure for measuring CRT symbol luminance and calculating contrast ratios. GRA

N80-33101# Air Force Medical Center, Wright-Patterson AFB, Ohio.
HEARING PROTECTION AND SPEECH COMMUNICATION CHARACTERISTICS OF SELECTED USAF INFLIGHT HELMETS
Mark R. Stephenson and Donald G. Tomerlin Jun. 1980 22 p refs
(AF Proj. 7231)
(AD-A088099; AFAMRL-TR-80-37) Avail: NTIS HC A02/MF A01 CSCL 06/17

Hearing protection and speech intelligibility were measured on three widely used flight helmets: the HGU-26/P with standard earcups, HGU-26/P with custom earcups and the DH-151. The following results were obtained: (1) Attenuation tests demonstrated the DH-151 and the standard HGU-26/P generally provide equivalent hearing protection with the former providing somewhat greater protection at the low and high frequencies, but the latter providing somewhat greater protection at the middle frequency region. The custom HGU-26/P provided less hearing protection than both of the above. (2) Replacing earcup assemblies with standard MX8376/AR earcups resulted in equal or improved hearing protection for the HGU-26/P helmet. In the DH-151 helmet, this resulted in less protection at the lower frequencies, but improved protection in the middle frequency range, and no change in the higher frequency range. (3) Speech intelligibility was determined by calculating the articulation index. Both the standard HGU-26/P and the DH-151 provide excellent speech intelligibility. The custom HGU-26/P was found to provide less speech intelligibility than the other two helmets. Nevertheless, we believe it would also permit adequate inflight speech communication. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see 33 Electronics and Electrical Engineering.

N80-33102*# Michigan Univ., Ann Arbor. Systems Engineering Lab.

EVALUATION OF COMPUTING SYSTEMS USING FUNCTIONALS OF A STOCHASTIC PROCESS

J. F. Meyer and L. T. Wu Jul. 1980 45 p refs

(Grant NsG-1306)

(NASA-CR-163512; Rept-014524-13-T; SEL-140) Avail: NTIS HC A03/MF A01 CSCL 09B

An intermediate model was used to represent the probabilistic nature of a total system at a level which is higher than the base model and thus closer to the performance variable. A class of intermediate models, which are generally referred to as functionals of a Markov process, were considered. A closed form solution of performability for the case where performance is identified with the minimum value of a functional was developed. T.M.

N80-33103# OMEX, Santa Clara, Calif.

SLIDESTORE LARGE CAPACITY INFORMATION STORAGE Final Report

Leslie L. Burns 1980 107 p

(Contract NSF DAR-78-21344)

(PB80-187875; NSF/RA-800049) Avail: NTIS HC A06/MF A01 CSCL 09B

A preliminary design for a large scale optical mass memory suitable for government, industrial, and commercial use is presented. The SlideStore feasibility model, which is based on the use of reactangular media for optical data recording by material ablation with a laser beam is decribed. The unit has successfully recorded raw data and read the data back in a manner that is suitable for transfer to a host computer. Included are descriptions of the model's potential market, the design guidelines, specifications, and media development. Depicted are artists' conceptions of a 2000 slide version of SlideStore for archival information; a 6000 slide version; and a 10 to the 15th power SlideStore memory a 6000 slide version; and a 10 to the 15th power SlideStore memory installation which uses nine 6000 slide SlideStore units as well as off-line storage of DataSlides. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-33104*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NONANALYTIC FUNCTION GENERATION ROUTINES FOR 16-BIT MICROPROCESSORS

James F. Soeder and Marynita Shaufl Washington Sep. 1980 66 p refs

(NASA-TM-81586; E-565) Avail: NTIS HC A04/MF A01 CSCL 09B

Interpolation techniques for three types (univariate, bivariate, and map) of nonanalytic functions are described. These interpolation techniques are then implemented in scaled fraction arithmetic on a representative 16 bit microprocessor. A FORTRAN program is described that facilitates the scaling, documentation, and organization of data for use by these routines. Listings of all these programs are included in an appendix. L.F.M.

N80-33105# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. of Space Systems.

COMPUTER TREATMENT OF PERSPECTIVE FOR SOLIDS [TRACADO POR COMPUTADOR DE PERSPECTIVAS DE SOLIDOS]

Jose Antonio Gocalves Pereira Jun. 1980 17 p refs In PORTUGUESE Presented at a Conf. in Sao Paulo, Brazil, 20-22 Aug. 1980

(INPE-1785-RPE/157) Avail: NTIS HC A02/MF A01

An algorithm is developed for computer treatment of concave or convex polyhedrons or series of polyhedrons. The algorithm solves the 'hidden lines' problem and is suited to computer programs and video terminals. S.F.

N80-33106# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ADVANCED SMITE REFERENCE MANUAL Final Report

Griffiss AFB, N.Y. RADC Feb. 1980 270 p refs

(Contract F30602-78-C-0016; AF Proj. 2529)

(AD-A087743; TRW-32584-6015-RU-00; RADC-TR-80-66) Avail: NTIS HC A12/MF A01 CSCL 09/2

This is a reference manual for the use of Advanced SMITE which is a higher level hardware description language used to describe various computer hardware architectures and then to generate an emulation of these architectures on the Nanodata QM-1 Microprogrammable Computer. Advanced SMITE is written in a subset of PL-1 and runs on RADC's MULTICS computer system. GRA

N80-33107# Washington Univ., Seattle. Dept. of Mathematics.

HOW MANY STEPS?

Victor Klee Jun. 1980 10 p refs

(Contracts N00014-67-A-0103; N00014-76-C-0423; NR Proj. 041-353)

(AD-A087860; TR-70) Avail: NTIS HC A02/MF A01 CSCL 12/1

Due in considerable measure to its connection with linear programming, the combinatorial study of convex polytopes has progressed greatly in the past twenty five years and many outstanding problems have been solved. However, the d-step conjecture, first formulated by W. M. Hirsch in 1957, remains unsettled. Both for its intrinsic interest and for its relationship to questions of computational complexity, it is probably the most important open problem on the combinatorial structure of polytopes. This report presents several equivalent forms of the d-step conjecture. Some deal explicitly with edge paths on polytopes, one involves matrix pivot operations, and one concerns an exchange process for simplicial bases. GRA

N80-33108# Ohio State Univ., Columbus. Dept. of Statistics.

ESTIMATION OF THE P(CS) WITH A COMPUTER PROGRAM, REVISION

Edward J. Dudewicz Jul. 1980 17 p refs

(Contract N00014-78-C-0543; NR Proj. 042-403)

(AD-A088058; TR-195A) Avail: NTIS HC A02/MF A01 CSCL 12/1

In the area of ranking and selection, recent papers have presented procedures which attempt to allow experimenters to take at least partial advantage of more favorable configurations of the population parameters (compared to least-favorable configuration). The current paper presents a computer program which allows experimenters to dispense with all of inequalities, an indifference-zone, and known equal variabilities in their assessment of the probability of correct selection. It has additional uses in implementation of recently proposed sequential adaptive selection procedures. GRA

N80-33109# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.

A TIME DEPENDENT ERROR DETECTION RATE MODEL

FOR SOFTWARE PERFORMANCE ASSESSMENT WITH APPLICATIONS Interim Technical Report, Sep. 1978 - Oct. 1979

Amrit L. Goel and K. Okumoto Griffiss AFB, N.Y. RADC May 1980 115 p refs
(Contract F30602-78-C-0351; AF Proj. 5581)
(AD-A088186; RADC-TR-80-179) Avail: NTIS HC A06/MF A01 CSCL 12/1

The objective of this study was to develop a parsimonious model whose parameters have a physical interpretation, and which can be used to predict various quantitative measures for software performance assessment. With this objective, the behavior of the software failure counting process {N(t), t equal to or greater than zero} has been studied. It is shown that N(t) can be well described by a nonhomogeneous Poisson process (NHPP) with a two parameter exponentially decaying error detection rate. Several measures, such as the number of failures by some prespecified time, the number of errors remaining in the system at a future time, and software reliability during a mission, have been proposed in this report. Models for software performance assessment are also derived. Two methods are developed to estimate model parameters from either failure count data or times between failures. A goodness-of-fit test is also developed to check the adequacy of the fitted model. Finally, actual failure data are analyzed from two DOD software systems. One is a large command and control system and the other a Naval data analysis system. GRA

N80-33110# University of Southern California, Marina del Rey. Information Sciences Inst.

MICROCODE VERIFICATION PROJECT Final Technical Report

Stephen D. Crocker, Leo Marcus, and Dono Van-Mierop May 1980 150 p refs
(Contract F30602-78-C-0008; AF Proj. 5581)
(AD-A088189; RADC-TR-80-42) Avail: NTIS HC A07/MF A01 CSCL 09/2

Within the scope of this project, a formalism for representing state transitions in a computationally tractable way has been invented, and a proof system based on this formalism has been designed and implemented. The representations of state transitions are called 'state deltas'. The basic proof system has been specialized for proofs about machine language and microcode by the addition of simplification rules for bitstring arithmetic, and by the addition of a translator from the ISPS machine description language to state deltas. Some experimentation with the system has been driven by a preliminary attempt to verify parts of the microcode of the Fault-Tolerant Spaceborne Computer (FTSC). The primary success to date has been the verification of the basic algorithm used for computing floating point square root. GRA

N80-33111# University of Southwestern Louisiana, Lafayette.

VARIABLE PRECISION AND INTERVAL ARITHMETIC PORTABLE ENHANCEMENTS TO FORTRAN Final Report, 15 Mar. 1978 - 14 Mar. 1980

Bruce D. Shriver Jul. 1980 269 p refs
(Grant DAAG29-78-G-0068)
(AD-A087564; ARO-15169.1-M) Avail: NTIS HC A12/MF A01 CSCL 09/2

It was the intent of the research reported here to develop, using preprocessing techniques, extensions to FORTRAN which would include: (1) the extended data types VPINTEGER, VPREAL, VPCOMPLEX and VPINTERVAL. The data types are analogous to those of standard FORTRAN and the single precision interval data type, but can be of arbitrary precision, (2) the standard built-in functions (SIN, COS, SQRT, etc.) for use with the new data types, and (3) the input/output facilities of standard FORTRAN extended for use with the extended data types. GRA

N80-33112# DBS Corp., Arlington, Va.

DEVELOPMENT OF SOFTWARE FOR COMPUTER ASSISTED MODEL SIMPLIFICATION Final Report

25 Apr. 1980 48 p
(Contract DE-AC01-79EI-10597)
(DOE/EIA-10597/T1) Avail: NTIS HC A03/MF A01

The design and assessment of software for computer assisted model simplification is addressed. LP matrix scaling, and particularly the potential usefulness of shadow price information for model simplification are examined. An algorithm for obtaining approximate shadow price information was developed and subjected to initial small scale testing with promising results. DOE

N80-33113# Oak Ridge National Lab., Tenn. Computer Sciences Div.

METHODS TO INSURE THE STANDARDIZATION OF FORTRAN SOFTWARE

P. W. Gaffney and J. W. Wooten May 1980 49 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-95) Avail: NTIS HC A03/MF A01

Four software tools PFORT, DAVE, POLISH, and BRNANL, which may be used to ensure the standardization of programs are loosely classified into three groups. Then reasons are given why the program in two of these groups should adhere to a portable subset of the American National Standard First FORTRAN 1966. The software tools PFORT, DAVE, POLISH, and BRNANL are briefly described, and an example of the dissemination of information pertaining to the tools together with their availability is outlined. DOE

N80-33114# California Univ., Livermore. Lawrence Livermore Lab.

THOR: A POST-PROCESSOR FOR TWO-DIMENSIONAL ANALYSIS CODES

John O. Hallquist 1 Apr. 1980 84 p refs
(Contract W-7405-eng-48)
(UCRL-52852) Avail: NTIS HC A05/MF A01

A user's manual for the post processor THOR is provided. THOR reads the binary plot files generated by two dimensional finite element codes and plots contours, time histories, and deformed shapes. Contours of a large number of quantities may be plotted on meshes consisting of triangular and variable node (4 to 8 nodes/element) quadrilateral elements. THOR can compute a variety of strain measures at either Gauss integration or nodal points, interface pressures along slide lines, reaction forces along constrained boudaries, spectra, and momentum. THOR is operational on the CDC 7600 and Cray-1 computers. DOE

N80-33115# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPUTER-ASSISTED CHART MAKING FROM THE GRAPHIC DESIGNER'S PERSPECTIVE

Aaron Marcus Apr. 1980 8 p refs Presented at Conf. of the Assoc. for Computing at Conf. Special Interest Group for Graphics, Seattle, 14 Jul. 1980
(Contract W-7405-eng-48)
(LBL-10239; CONF-800720-1) Avail: NTIS HC A02/MF A01

It is important to improve the aesthetics and effectiveness of information graphics through greater awareness of graphic design as a visual communication discipline. Chart making is one subject area in which graphic design awareness can be enhanced. Basic design principles are reviewed which are relevant to creating better charts. Examples demonstrate improvements. DOE

N80-33116# Machine Intelligence Corp., Mountain View, Calif.

MICROCOMPUTER-BASED NATURAL-LANGUAGE UNDERSTANDING, PHASE 1 Final Technical Report, 1 Oct. 1979 - 28 Mar. 1980

Charles A. Rosen and Norman Haas 1980 48 p refs
(Grant NSF DAR-79-17648)
(PB80-187370; NSF/RA-800047) Avail: NTIS HC A03/MF A01 CSCL 05G

The cost effectiveness of natural language processing in support of industrial productivity is examined. Principal results include: development of a grammar for characterizing, in machine understandable form, a significant and habitable subset of the English language for use in building, updating, and querying databases; development of new, compact data structures for encoding grammatical rules and lexical information suitable for use with microcomputers; development of an efficient parsing algorithm of natural languages, and its implementation in PASCAL; and clear demonstration of the feasibility of microcomputer-based, natural-language processing as defined. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-33117# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DISTRIBUTED NETWORK PROTOCOLS
Adrian Segall (Technion, Haifa, Israel) Jul. 1980 54 p refs Submitted for publication
(Contract N00014-75-C-1183; ARPA Order 3045; NR Proj. 049-383)
(AD-A087623; LIDS-P-1014) Avail: NTIS HC A04/MF A01 CSCL 09/2

A unified approach to the formal description and validation of several distributed protocols is presented. After introducing two basic protocols, a series of known and new protocols for connectivity test, shortest path and path updating are described and validated. All protocols are extended to networks with changing topology. GRA

N80-33118# IBM Federal Systems Div., Owego, N. Y.
FAULT TOLERANT COMPUTER NETWORK STUDY Interim Report, Sep. 1979 - Mar. 1980
Webb T. Comfort, T. L. Anthony, T. R. Battle, J. E. Kaufman, and P. M. Kogge Apr. 1980 172 p refs
(Contract F33615-79-C-1180; AF Proj. 2003)
(AD-A088065; IBM-80-D68-001; AFWAL-TR-80-1046) Avail: NTIS HC A08/MF A01 CSCL 09/2

This interim report documents some baseline parameters and considerations for a fault tolerant avionics system. Issues addressed include reliability, computational requirements, fault tolerant techniques, cost effectiveness, error types, computer networks, and analysis techniques. Candidate life-cycle cost models are reviewed for applicability in evaluating fault tolerant architectures, and a study plan for assessment of the cost/effectiveness of fault tolerant techniques is presented. GRA

N80-33119# California Univ., Livermore. Lawrence Livermore Lab.
MULTIPLE ACCESS MASS STORAGE NETWORK
Donaldson L. Wentz, Jr. 1980 14 p refs Presented at Networks 80 Intern. Conf., London, 3 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-83929; CONF-800638-1) Avail: NTIS HC A02/MF A01

The multi-access storage subnetwork (MASS) is described which provides shared mass storage for a multiple-host computer configuration. A mass storage facility is interfaced by MASS to large, scientific worker computers to provide an on-line capacity of 1 trillion bits of user-accessible data. The key design features of the subnetwork that contribute to the high performance include the following: a data transmission scheme that provides a 40 Mbit/s channel over distances of up to 1000 ft, a large metal-oxide semiconductor (MOS) memory buffer controlled by a 24 port memory multiplexer with an aggregate data rate of 280 Mbit/s, and a set of high-speed microprocessor based controllers driving the commercial mass storage units. Reliability of the system is provided by a completely redundant network, including two control minicomputer systems. Also enhancing reliability is error detection and correction in the MOS memory. DOE

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-33120# RAND Corp., Santa Monica, Calif.
KNOWLEDGE ACQUISITION, KNOWLEDGE PROGRAMMING, AND KNOWLEDGE REFINEMENT
Frederick Hayes-Roth, Philip Klahr, and David J. Mostow May 1980 39 p
(Grant NSF MCS-77-03273)
(RAND/R-2540-NSF) Avail: NTIS HC A03/MF A01

The iterative refinement of knowledge in response to actual experience is explained. A machine uses knowledge acquired initially from a human, who provides enough concepts, constraints, and problem-solving heuristics to define some minimal level of performance. A learning system must use existing knowledge to plan reasonable courses of action, carry those plans out, and then diagnose weaknesses that explain observed failures or unexpected successes. The processes of planning, acting, and evaluation cooperate to produce new knowledge by refining and extending prior knowledge. A system learn by increasing the scope, precision, validity, and power of its current knowledge. That knowledge includes descriptions and models of the environment, as well as planning and problem solving techniques for achieving goals. Learning requires the system to augment, generalize, specialize, validate, and exploit the knowledge it possesses at any point in time. A.R.H.

N80-33121# Brown Univ., Providence, R. I. Center for Dynamical Systems.
APPROXIMATION SCHEMES FOR THE LINEAR-QUADRATIC OPTIMAL CONTROL PROBLEM ASSOCIATED WITH DELAY EQUATIONS Interim Report
Karl Kunisch (Technische Univ., Graz) Mar. 1980 71 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088245; AFOSR-80-0577TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The linear regulator problem for delay equation is discussed. We propose a (theoretical) solution involving Riccati integral equations and them axiomatically discuss a general approximation scheme. The details are given for spline and averaging approximations. GRA

N80-33122# Brown Univ., Providence, R. I. Center for Dynamical Systems.
THE RICCATI INTEGRAL EQUATION ARISING IN OPTIMAL CONTROL OF DELAY DIFFERENTIAL EQUATIONS Interim Report
Karl Kunisch (Technische Univ., Graz) 10 Jun. 1980 16 p refs Presented at Intern. Conf. on Nonlinear Phenomena in Math. Sci., Arlington, Tex., 16-20 Jun. 1980
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088097; AFOSR-80-0564TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper we discuss the linear regulator problem associated with delay-differential equations. Formulas for the optimal feedback control and optimal trajectory are derived; this naturally leads to a Riccati integral equation in the state space of the delay equation. Finally, the linear regulator problem for the delay equation is approximated by sequences of regulator problems associated with ordinary differential equations in Euclidean space. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-33123*# Lassen Research, Manton, Calif.
WINDFIELD RETRIEVAL FROM DOPPLER LIDAR OBSERVATIONS Interim Technical Report
R. W. Lee Jun. 1980 20 p
(Contract NAS8-33389)
(NASA-CR-161572; ITR-1) Avail: NTIS HC A02/MF A01 CSCL 12A

An approach to the retrieval of a vector wind field from Doppler lidar observations is developed in general terms. The field of radial velocity measurements from each look angle is modeled by a smooth surface, the parameters of the model being determined from the data by least squares techniques. The vector wind field and higher-order fields are obtained from the two modeled surfaces. Estimated measurement errors are taken into account, and error estimates are available for all output data sets. Author

N80-33124# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL STRATEGIES FOR SECOND GUESSERS
J. Michael Steele and Jim Zidek 25 Feb. 1980 29 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031; NR Proj. 042-267)
(AD-A087897; SU-TR-281) Avail: NTIS HC A03/MF A01 CSCL 12/1

A model is given for a class of contests in which the participants try to guess (or estimate) unknown quantities, and the objective of each player is to come closer to the unknown quantities than his adversary. A general optimality result is proved which gives the best guessing rules for the second guesser. These rules are first calculated exactly in a certain hierarchical linear model, and then simpler approximate rules are given.GRA

N80-33125# Washington Univ., Seattle. Dept. of Mathematics.
THE DIAMETER OF ALMOST ALL BIPARTITE GRAPHS
V. L. Klee, D. G. Larman, and E. M. Wright May 1980 10 p refs Sponsored in part by Army
(Contract N00014-67-A-0103; NR Proj 044-353)
(AD-A087687; TR-68) Avail: NTIS HC A02/MF A01 CSCL 12/1

The diameter of graphs is addressed with specific reference to the case of bipartite graphs on N labelled points and M = M(N)< or = N labelled points. Of the 2(MN) such graphs, some are disconnected and the others have diameters ranging from 2M or 2M-1 down to 2. Denoting by P(n) the proportion of the graphs which are of diameter 3, it is proved as a necessary and sufficient condition, namely P(n) approaches 1 as n approaches infinity, that M(N) log (4/3)-2 log N approaches positive infinity. Some related results and unsolved problems are also mentioned. M.G.

N80-33126# Naval Ocean Systems Center, San Diego, Calif. Systems Application Div.
COMPARISON OF DETECTION PERFORMANCE OF SELECTED TWO-CHANNEL ALGORITHMS Final Report
D. J. Edelblute and C. L. Meland 28 Sep. 1979 40 p refs
(ZR0110812)
(AD-A087797; NOSC/TD-328) Avail: NTIS HC A03/MF A01 CSCL 09/4

Recent work on intersensor processing has stimulated interest in techniques for determining information common to two data sequences which may be used for detection, tracking or a combination of these and other functions. Three algorithms which seemed naturally to suggest themselves for intersensor processing were compared. It was determined that the use of a normalization factor significantly degrades detection performance in regions characterized by low time-bandwidth product TW < or = 64. For TW < or = 120, all three algorithms performed about equally on the detection function. The principal implication of this work is that the operating mode of the system (which may dictate the low time-bandwidth product used) may affect the choice of algorithms to be used. In a tactical application where decisions must be made quickly, use of an unnormalized correlator may be mandatory. In a situation where long integration times are acceptable, a normalized formula such as the coherence detector may be chosen for data processing, as opposed to signal processing, economies. GRA

N80-33127# Georgia Inst. of Tech., Atlanta. School of Industrial and Systems Engineering.
AN ALGORITHM FOR LINEARLY CONSTRAINED NONLINEAR PROGRAMMING PROBLEMS Interim Report
Mokhtar S. Bazaraa and Jamie J. Goode 1980 23 p refs
(Contract F49620-79-C-0120; AF Proj. 2304)
(AD-A085458; AFOSR-80-0449TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm for solving a linearly constrained nonlinear programming problem was developed. Given a feasible point, a correction vector was computed by solving a least distance programming problem over a polyhedral cone defined in terms of the gradients of the almost binding constraints. Mukai's approximate scheme for computing step sizes was generalized to handle the constraints. This scheme provided an estimate for the step size based on a quadratic approximation of the function. This estimate was used in conjunction with Armijo line search to calculate a new point. Each accumulation point is a Kuhn-Tucker point to a slight perturbation of the original problem. Under suitable second order optimality conditions, eventually only one trial is needed to compute the step size. T.M.

N80-33128# Harry Diamond Labs., Adelphi, Md.
INVERTIBLE BINARY MATRICES
Thomas C. Jedrey May 1980 14 p ref
(DA Proj. 1L1-61101-A-91A)
(AD-A085575; HDL-TM-80-13) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two procedures are developed for the generation of an invertible modulo two matrix which satisfies an algorithm that minimizes the number of nonzero coefficients in a Haar expansion of a Boolean function. The first method is based on an algorithm for the production of invertible modulo two matrices, while the other produces the required matrix by a direct examination of the input vector T. Both methods have been implemented in VSAPL, and the program for the second technique, which can generate much larger matrices, is included. M.G.

N80-33129# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
GENERIC PROPERTIES OF AN INTEGRO-DIFFERENTIAL EQUATION Interim Report
Jack K. Hale Jun. 1980 14 p refs
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)
(AD-A088242; AFOSR-80-0575TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider the functional differential equation where a,g are continuous. The linear function is such that the characteristic equation has two eigenvalues on the imaginary axis and the remaining ones with negative real parts. In spite of this, it is shown there is no generic Hopf bifurcation for any g. The nature of the bifurcation is characterized under hypotheses which appear to be generic in g. GRA

N80-33130# Tennessee Univ., Knoxville. Dept. of Mathematics.
A ZERO-ONE LAW FOR A CLASS OF MEASURES ON GROUPS
Balram S. Rajput, Donald Louie, and Albert Tortrat (Paris Univ., France) Sep. 1979 11 p refs
(Contract N00014-78-C-0468)
(AD-A088374; TR-7905) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let (E beta) be a measurable (nonabelian) group, alpha a measurable homomorphism on E and mu a law on (E beta) satisfying mu = mu(alpha) v(alpha) (with mu(alpha) = mu o/alpha), for some law v(alpha) on (E beta). Under some additional conditions it is shown that, for every proper normal subgroup G of E and a in E, if Ga is an element of beta (mu), the mu-completion of B, then mu(Ga) = 0 or 1. As a corollary, it is shown that this result yields all previously known 0-1 laws for stable, semistable, and quasistable laws on linear spaces as well as new 0-1 laws for other classes of infinitely divisible laws on linear spaces. GRA

N80-33131# Maryland Univ., College Park. Dept. of Mathematics.
SOME GRAPHICAL CONSIDERATIONS IN TIME SERIES ANALYSIS Interim Report
Benjamin Kedem Jun. 1980 27 p refs
(Grant AF-AFOSR-0211-80; AF Proj. 2304)
(AD-A088246; MD80-43-BK; AFOSR-80-0590TR; TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 12/1

The pictorial information in a stationary time series as depicted by crossings of levels and crossings of random levels and related quantities is studied. It is shown that such graphical features are directly connected with the covariance function and hence with the spectral density. Many of these features can be actually applied in estimation and in the study of extremes. In the Gaussian case, the finite dimensional distributions are completely determined by the axis crossings and by the crossings of a random curve (to be defined) if the process is essentially bounded. GRA

N80-33132# Stanford Univ., Calif. Dept. of Operations Research.
NEAR-EQUIVALENCE OF NETWORK FLOW ALGORITHMS
Norman Zadeh 1 Dec. 1979 55 p refs
(Contract N00014-75-C-0493; Grant NSF ENG-76-12286; NR Proj. 042-264)
(AD-A088032; SU-TR-36) Avail: NTIS HC A04/MF A01 CSCL 12/1

Network problems arising in practice typically have non-negative arc costs. On such problems, we show that the following algorithms perform, modulo ties, the same sequence of flow augmentations. (1) Simplex (with the standard pivot rule and Big-M start), (2) Out-of-Kilter (Primal-Dual), (3) Dual Simplex (with the standard pivot rule), (4) Lemke's Complementary Pivot Algorithm. All methods compute a shortest path tree by mimicking the Dijkstra algorithm and then send flow along a sequence of minimum cost paths. Differences in implementation are discussed. It becomes clear that Dantzig's simplex method with the best empirical pivot rule (not the standard rule) will outperform other methods (variations of Simplex with the standard rule). A simple reason is given why Dual Simplex (best empirical) cannot do as well as Simplex (best empirical). GRA

N80-33133# Iowa Univ., Iowa City. Dept. of Statistics.
ON MEASURING THE CONFORMITY OF A PARAMETER SET TO A TREND, WITH APPLICATIONS
Tim Robertson and F. T. Wright (Missouri Univ. -Rolla) Jul. 1980 27 p refs
(Contracts N00014-80-C-0321; N00014-80-C-0322; Grant NSF MCS-78-01514)
(AD-A087946; TR-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

Consider the hypothesis H (sub 1): theta (sub 1 >) or = theta (sub 2 >) or = theta (sub k) regarding a collection, of unknown parameters. It is clear that this trend is reflected in certain possible parameter sets more than in others. A quantification of this notion of conformity to a trend, which was suggested by Barlow and Brunk (1972), is studied. Applications of the resulting theory to several order restricted hypothesis tests are presented. GRA

N80-33134# Brown Univ., Providence, R.I. Center for Dynamical Systems.
IDENTIFICATION OF NONLINEAR DELAY SYSTEMS USING SPLINE METHODS Interim Report
H. T. Banks Jun. 1980 17 p refs
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)
(AD-A088251; AFOSR-80-0563TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Spline based approximation schemes for nonlinear nonautonomous functional differential equation control systems are discussed and it is shown how these may be employed in parameter estimation techniques. A sample of our numerical findings is also presented. GRA

N80-33135# Brown Univ., Providence, R.I. Center for Dynamical Systems.
FUNCTIONAL DIFFERENCE EQUATIONS AND AN EPIDEMIC MODEL Interim Report
Lawrence Turyn 9 Jun. 1980 14 p refs Presented at Intern. Conf. on Nonlinear Phenomena in Math. Sci., Arlington, Tex., 16-20 Jun. 1980
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088108; AFOSR-80-0565TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider an epidemic model for the form S implies I which implies S with history on (-infinity, 0). The well-known threshold phenomenon is discussed in terms of the stability of a functional difference equation, also known as the translation-invariant renewal equation. Since the difference equation has infinite delay, the work of other authors on finite-delay problems is extended. Also, epidemic models with spatial effects are discussed by extension of the results to difference equations in a Banach space. GRA

N80-33136# South Carolina Univ., Columbia. Dept. of Mathematics Computer Science and Statistics.
ASYMPTOTICALLY DISTRIBUTION-FREE SIMULTANEOUS CONFIDENCE REGION OF TREATMENT DIFFERENCES IN A RANDOMIZED COMPLETE BLOCK DESIGN Interim Report
L. J. Wei Feb. 1980 12 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088115; AFOSR-80-0588TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For a randomized complete block design with additive block effects, an asymptotically distribution-free simultaneous confidence region of pairwise treatment differences is presented. The corresponding confidence bound has an explicit form and is easily obtained. An example is provided for illustration purpose. The case of treatment against control is also discussed. GRA

N80-33137# Rhode Island Univ., Kingston. Dept. of Mathematics.
A UNIQUENESS THEOREM FOR ORDINARY DIFFERENTIAL EQUATIONS Interim Report
M. J. Norris (Sandia National Labs., Albuquerque, N. Mex.) May 1980 8 p refs
(Contracts F49620-79-C-0129; DE-AC04-76DP-00789; AF Proj. 2304)
(AD-A088113; AFOSR-80-0585TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A uniqueness theorem is proved which answers an open question for a system of differential equations arising in a certain n-body problem of classical electrodynamics. The essence of the results can be illustrated using the scalar prototype equation x'' = g sub 1(x) + g sub 2 (t + x) with x(0) = 0. The solution of the latter is unique provided g sub 1 and g sub 2 are continuous positive functions of bounded variation. M.G.

N80-33138# Cincinnati Univ., Ohio. Dept. of Mathematical Sciences.
NUMERICAL REGULARIZATION OF ILL-POSED PROBLEMS Final Report
C. W. Groetsch 9 Jul. 1980 72 p refs
(Grant AF-AFOSR-0059-79; AF Proj. 2304)
(AD-A088073; AFOSR-80-0573TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Contents: generalized inverses and generalized splines; on the Kryanev-Lardy method for ill-posed problems; On a class of regularization methods; the parameter choice problem in linear regularization; a mathematical introduction. GRA

N80-33139# Illinois Univ. at Urbana-Champaign. Computer Science Dept.
RAPID SOLUTION OF FINITE ELEMENT EQUATIONS ON LOCALLY REFINED GRIDS BY MULTI-LEVEL METHODS Ph.D. Thesis
John R. VanRosendale May 1980 123 p refs
(Grant AF-AFOSR-2854-75; AF Proj. 2304)
(AD-A088065; UIUCDCS-R-80-1021; UILU-ENG-80-1712; AFOSR-80-0591TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis is concerned with the use of multi-level methods to solve the linear systems arising from finite element discretizations of elliptic equations. In all, three multilevel methods are considered. The first of these is applicable only to quasi-uniform grids, but is simpler than other algorithms considered in previous theoretical work. The other two algorithms are applicable to both quasi-uniform grids, and locally refined grids, those grids on which the size of the largest and smallest elements many differ by an arbitrarily large factor. All three algorithms are asymptotically optimal, producing good solutions in O(N) operations on a finite element grid with N elements. These asymptotically optimal complexity bounds for the last two algorithms are the first such bounds for multilevel methods on locally refined grids. One of these algorithms achieves this O(N) complexity bound under weaker than expected conditions on the dimensions of the finite element spaces used by the algorithm. GRA

N80-33140# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
RECENT ADVANCES IN THE EDGE-FUNCTION METHOD 1979-1980 Final Scientific Report, 2 Feb. 1979 - 1 Feb. 1980

Patrick M. Quinlan 30 Jul. 1980 24 p refs
(Grant AF-AFOSR-0075-79; AF Proj. 2301)
(AD-A088328; EOARD-TR-80-14) Avail: NTIS HC A02/MF A01 CSCL 20/11

Main advances of E.F.M. in 1979-80 dealt with are: (1) anisotropic thin plates, (2) free vibrations of thin plates, (3) analysis of bridge slabs, (4) elliptical cracks in a prismoidal body. abstracts, conclusions, and illustrative examples are given in this report. GRA

N80-33141# Aeronautical Research Associates of Princeton, Inc., N. J.

SOLITONS AND THE INVERSE SCATTERING TRANSFORM

Harvey Segur 1980 56 p refs
(Contracts N00014-80-C-0048; DAAG29-78-C-0003)
(AD-A088023; ARAP-TM-80-6) Avail: NTIS HC A04/MF A01 CSCL 12/1

Under appropriate conditions, ocean waves may be modeled by certain nonlinear evolution equations that admit soliton solutions and can be solved exactly by the inverse scattering transform (IST). The theory of these special equations is developed in five lectures. As physical models, these equations typically govern the evolution of narrow-band packets of small amplitude waves on a long (post-linear) time scale. This is demonstrated in lecture 1, using the Korteweg-deVries equation as an example. Lectures 2 and 3 develop the theory of IST on the infinite interval. The close connection of aspects of this theory to Fourier analysis, to canonical transformations of Hamiltonian systems, and to the theory of analytic functions is established. Typical solutions, including solitons and radiation, are discussed as well. With periodic boundary conditions, the Korteweg-deVries equation exhibits recurrence, as discussed in lecture 4. The fifth lecture emphasizes the deep connection between evolution equations solvable by IST and Painleve transcendents, with an application to the Lorenz model. GRA

N80-33142# Princeton Univ., N. J. Information Sciences and Systems Lab.

THE OFF-LINE USE OF A SEQUENTIAL ESTIMATOR

Thomas G. Robertazzi and Stuart Schwartz Jul. 1980 81 p refs
(Contract N00014-80-C-0530; NR Proj. 042-385)
(AD-A088178; TR-4) Avail: NTIS HC A05/MF A01 CSCL 12/1

The straightforward application of a sequential estimator to nonlinear regression (curve fitting) problems is generally not possible when good a priori parameter estimates are not available and also when minimizing the error over a local portion of the data does not insure that it is minimized globally. However, a sequential estimator may be easily utilized to perform off-line processing in such a situation. The key is to process the measurements in a random order rather than the causal order in which they occur. The off-line use of an extended Kalman filter is illustrated in terms of a particular application. This technique is essentially a sequential version of the Gauss-Newton minimization procedure with relinearization being performed after each measurement is processed. Fictitious measurement noise is necessary to prevent filter divergence and is included in a very simple manner. Computational savings over more conventional iterative minimization techniques are possible if the functions and partial derivatives involved are sufficiently complex to evaluate. But there is a real question regarding the extent to which convergence can be assured. The results of simulations are presented. GRA

N80-33143# Tennessee Univ., Knoxville. Dept. of Mathematics.

SEMISTABLE LAWS ON TOPOLOGICAL VECTOR SPACES Interim Report

Dong M. Chung (Sogang Univ., Seoul), Balram S. Rajput, and Albert Tortrat (Paris Univ.) Sep. 1979 24 p refs
(Contract N00014-78-C-0468; NR Proj. 042-400)
(AD-A088224; TR-7901) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper three types of results were discussed: firstly, two Levy-Khinchin type representations of Poisson type infinitely divisible (I.D.) laws on certain topological vector (TV) spaces-one of these complements a known representation due to Dettweiler; secondly, the r-semistable laws on locally convex TV spaces and also obtain good representation of their characteristic functions; finally, the existence and the continuity of the semigroup mu superscript t where t greater than 0 of I.D. laws mu on locally convex TV spaces. These complement similar known results of Siebert. GRA

N80-33144# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

ON THE ALMOST SURE CONVERGENCE OF WEIGHTED SUMS OF RANDOM ELEMENTS IN D[0, 1) Interim Report

Robert Lee Taylor and C. A. Calhoun Jun. 1980 15 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088330; TR-56; AFOSR-80-0570TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The convergence of weighted sums of random elements in D[0,1) was obtained by Taylor and Daffer (1979) using a number of conditions such as convex tightness, moment conditions, and others. In this paper both the moment conditions and the tightness conditions are substantially relaxed in obtaining the almost sure convergence of weighted sums of random elements in D[0,1). In addition, a brief discussion of the necessary integral conditions will be included which will delineate these results and previous work. GRA

N80-33145# Illinois Univ., Urbana. Dept. of Computer Science.

COMPILING FAST PARTIAL DERIVATIVES OF FUNCTIONS GIVEN BY ALGORITHMS Ph.D. Thesis

Bert Speelpenning Jan. 1980 87 p refs
(Contracts DE-AS02-76ER-02383; EY-76-S-02-2383)
(COO-2383-0063; UILU-ENG-80-1702; UIUCDS-R-80-1002)
Avail: NTIS HC A05/MF A01

Symbolic methods for computing derivatives of functions that make full use of the function text are described. The system Jake described produces gradients significantly faster than numerical differencing. Jake can handle algorithms Af with arbitrary flow of control. Measurements performed on one particular machine suggest that Jake is faster than numerical differencing for > 8. Somewhat weaker results were obtained for the problem of computing Jacobians of arbitrary shape. DOE

N80-33146# Oak Ridge National Lab., Tenn. Computer Sciences Div.

BOUNDARY INTEGRAL EQUATION METHOD FOR FRACTURE PROBLEMS WITH MIXED MODE DEFORMATIONS

S. J. Chang and R. B. Morgan Jun. 1980 51 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-57) Avail: NTIS HC A04/MF A01

A numerical method which is based on the boundary integral equation formulation in elasticity is established to solve two dimensional problems of linear fracture mechanics. The scheme requires the superposition of a crack problem in an infinite region and an elastic problem which does not contain the crack but has an identical outer boundary condition to that of the given problem. DOE

N80-33147# Illinois Univ., Urbana.

AUTOMATIC MULTIRATE METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS

C. W. Gear Jan. 1980 15 p refs
(Contract DE-AS02-76ER-02383)
(COO-2383-0062; UIUCDS-R-80-1000; UILU-ENG-80-1701)
Avail: NTIS HC A02/MF A01

A study is made of the application on integration methods in which different step sizes are used for different members of a system of equations. Such methods can result in savings if the cost of derivative evaluation is high or if a system is sparse; however, the estimation and control of errors is very difficult and can lead to high overheads. Three approaches are discussed, and it is shown that the least intuitive is the most promising. DOE

N80-33148# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

ESTIMATORS FOR THE TRUNCATED BETA-BINOMIAL DISTRIBUTION
Corwin L. Atwood 1980 32 p refs Presented at 173d Inst. of Math. Statistics Conf., Davis, Calif., 16 Jun. 1980
(Contract DE-AC07-76ID-01570)
(CONF-800644-1) Avail: NTIS HC A03/MF A01

Let X have a beta-binomial(m,p,theta) distribution, truncated such that X > t for t = 0 or 1. Suppose that independent observations of X are available. A consistent estimator of (p,theta) is given, based on the first three sample moments. This may be used as a start for maximum likelihood estimation (MLE) or jackknifing. The standard assumptions for a C(alpha) test that X is truncated binomial do not hold; however a test is proposed based on jackknifing the sample variance of X. Some Monte Carlo comparisons are given. For moderately small data sets, these comparisons show that the moment estimator is often superior to the MLE, and the C(alpha) test is superior to other proposed tests, in spite of its lack of theoretical justification. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-33149*# Kentron International, Inc., Hampton, Va.
OZONE DATA AND MISSION SAMPLING ANALYSIS
John L. Robbins Sep. 1980 156 p refs
(Contract NAS1-16000)
(NASA-CR-159342; V-19100/0LTR-032) Avail: NTIS HC A08/MF A01 CSCL 12A

A methodology was developed to analyze discrete data obtained from the global distribution of ozone. Statistical analysis techniques were applied to describe the distribution of data variance in terms of empirical orthogonal functions and components of spherical harmonic models. The effects of uneven data distribution and missing data were considered. Data fill based on the autocorrelation structure of the data is described. Computer coding of the analysis techniques is included. T.M.

N80-33150# Stanford Univ., Calif. Dept. of Statistics.
DETECTING CHANGE POINTS IN SAMPLING FROM MULTINOMIAL DISTRIBUTIONS
Alan E. Gelfand 4 Mar. 1980 44 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031; NR Proj. 042-267)
(AD-A087898; TR-282) Avail: NTIS HC A03/MF A01 CSCL 12/1

The question of if and when a change in the underlying cell frequencies has occurred during the observation of a sequence of categorical variables is analyzed. Several techniques are developed that may be loosely grouped into three classifications: (1) central limit theorem approaches, (2) departure from centrality approaches and (3) test of homogeneity approaches. The approaches monitor the sequence either at every trail or at every kth trial. All approaches construct statistics which are functions of sequential sums either weighted or unweighted. The behavior of these sums and the statistics developed from them are discussed in detail. A large scale simulation study is discussed in an attempt to assess the performance of the approaches. Three approaches emerge as most promising but a clear choice among these is not possible at present. GRA

N80-33151# Colorado State Univ., Fort Collins. Dept. of Statistics.
CONFIDENCE INTERVALS ON NONNEGATIVE LINEAR COMBINATIONS OF VARIANCES
Franklin A. Graybill and Chih-Ming Wang Apr. 1980 20 p refs
(Contract N00014-78-C-0463; NR Proj. 042-402)
(AD-A084194; CSU-TR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method for setting confidence limits on linear combinations of variances is explained. S.F.

N80-33152# Bell Telephone Labs., Inc., Holmdel, N. J.
THE INFLUENCE CURVE AND GOODNESS OF FIT
John R. Michael and William R. Schucany (Southern Methodist Univ.) May 1980 24 p refs
(Contract N00014-75-C-0439; NR Proj. 042-280)
(AD-A085593; TR-137) Avail: NTIS HC A02/MF A01 CSCL 12/1

The influence curve introduced by Hampel is applied to goodness of fit statistics. The efficacy curve is then defined to be the square of influence curve weighted by a constant which arises in the context of approximate Bahadur efficiency. For a number of goodness of fit statistics the ratios of these curves are shown to be equal to the asymptotic relative efficiency in the Pitman sense when testing for point contamination. These efficacy curves graphically demonstrate the sensitivities of certain goodness of fit statistics to minor perturbations in the assumed distribution. GRA

N80-33153# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
PARAMETER ESTIMATION TECHNIQUES FOR NONLINEAR DISTRIBUTED PARAMETER SYSTEMS Interim Report
H. T. Banks and Karl Kunisch (Technische Univ., Graz, Austria) 27 May 1980 22 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A088244; AFOSR-80-0579TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Methods for estimating system parameters are discussed for a class of partial differential equations. We develop schemes based on modal subspace approximations in some detail and include numerical examples. GRA

N80-33154# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ANALYSIS OF NONLINEAR STOCHASTIC SYSTEMS WITH WIDE-BAND INPUTS Interim Report
Harold J. Kushner and Y. Bar-Ness Jun. 1980 20 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-77-12946; AF Proj. 2304)
(AD-A088243; AFOSR-80-0578TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general method for approximating systems with wide-band inputs by diffusion processes is discussed. The input noise itself can be processed nonlinearly by elements of the system. One particular case, examined in detail, is that of a hard limiter just after the input. The results suggest that the limiter can actually improve performance if the noise intensity is small. The development illustrates how tricky, but potentially useful, nonlinearities can be handled when the system input is wide-band noise. GRA

N80-33155# Maryland Univ., College Park. Dept. of Mathematics.
ON NEAREST NEIGHBOR DEGENERACIES OF INDISTINGUISHABLE PARTICLES Interim Report
Benjamin Kedem Jun. 1980 22 p refs
(Contract F49620-79-C-0095; AF Proj. 2304)
(AD-A088247; MD80-37-BK; TR-80-36; AFOSR-80-0589TR)
Avail: NTIS HC A02/MF A01 CSCL 12/1

Arrangement degeneracies suggested by sufficient statistics associated with binary stationary mth order Markov chains are discussed, and are shown to correspond and generalize some degeneracies arising when indistinguishable particles are placed on a one dimensional lattice with n compartments. From these statistics it is possible to define an mth order unit. The arrangement degeneracy obtained from s 1's and n-s 0's so that lower order units are placed in higher order units is solved. However, the most general arrangement degeneracy associated with all the sufficient statistics of a given order is difficult. For this case only the 3rd order arrangement degeneracy is obtained, the 1st and 2nd orders being relatively simple. These results are applied in determining the asymptotic distributions of rare events. GRA

N80-33156# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
NONPARAMETRIC BAYES ESTIMATION OF DISTRIBUTION FUNCTIONS AND THE STUDY OF PROBABILITY

DENSITY ESTIMATES Interim Report, 1 Jun. 1979 - 31 May 1980
W. J. Padgett, R. L. Taylor, and L. J. Wei 30 Jun. 1980 18 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088250; AFOSR-80-0571TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In work under this grant, major results were obtained in the four broad areas of survival analysis and life testing, probability density estimates and laws of large numbers, estimation after testing, and robustness and distribution-free procedures. In particular, nonparametric estimators of the failure rate function and survival probability were developed under the assumption of increasing failure rate using both maximum likelihood and Bayesian approaches. These particular results have attracted wide attention due to their generality and applicability in survival analysis and reliability estimation from arbitrarily right-censored data. Also, consistency results for both univariate and multivariate kernel estimates for probability density functions and regression functions were obtained using techniques and results of function-space probability theory. Sequential procedures were developed and analyzed which provided interval estimators of the parameter of interest after testing certain hypotheses. Various robustness and nonparametric methods for incomplete samples and broken samples were also studied. Thus, maintenance policies and development of new, more reliable, equipment may be formulated using statistical procedures and theory from these results. GRA

N80-33157# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
ASYMPTOTIC CONSERVATIVENESS AND EFFICIENCY OF KRUSKAL-WALLIS TEST FOR K DEPENDENT SAMPLES Interim Report
L. J. Wei May 1980 14 p refs
(Contract F49620-79-C-0140; AF Proj. 2034)
(AD-A088249; AFOSR-80-0566TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The robustness (asymptotic conservativeness) of Kruskal-Wallis test under certain departures from mutual independence of K univariate samples is established. This robustness provides a procedure for testing the equality of K marginal distribution functions on a broken random sample from a K-variate distribution which satisfies a mild condition. For the unbroken sample, a generalized Kruskal-Wallis test is proposed for testing the symmetry of a K-dimensional distribution function. The relative efficiency of the K-W test against the aligned rank order test is also examined under the normal shift model. GRA

N80-33158# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
SOME BAYES ESTIMATORS OF RELIABILITY FOR THE INVERSE GAUSSIAN LIFETIME MODEL Interim Report
W. J. Padgett Feb. 1980 13 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A088078; AFOSR-80-0584TR; TR-53) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bayes estimation of the reliability function for the inverse Gaussian distribution is discussed. For the case that the mean lifetime is known, Bayes estimators are obtained with Jeffreys' noninformative prior and with the natural conjugate prior for the scale parameter. In the case that both parameters are unknown, an estimator of reliability is suggested which is based on the Bayes estimator obtained for the case that the mean lifetime is known. This estimator is not Bayes but compares favorably with the maximum likelihood and minimum variance unbiased estimators as indicated by computer simulations. GRA

N80-33159# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE FIRST PASSAGE TIME DISTRIBUTION FOR A CLASS OF MARKOV CHAINS
Mark Brown and C. N. Rao Jul. 1980 17 p refs
(Contract F49620-79-C-0157; Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A088111; FSU-Statistics-M552; TR-79-B5; AFOSR-80-0581TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider a stochastically monotone Markov chain with monotone paths on a partially ordered countable set S. Let C be an increasing subset of S with finite complement. Then the first passage time from an element of S to C is shown to be IFRA (increasing failure rate on the average). Several applications are presented including coherent systems, shockmodels, and convolutions of IFRA distributions. GRA

N80-33160# Princeton Univ., N. J. Dept. of Statistics.
FORMULAS FOR A TWO-SAMPLE MONTE CARLO SWINDLE
Karen Kafadar Nov. 1979 13 p refs
(Grant DAAG29-76-G-0298)
(AD-A088072; TR-153-SER-2; ARO-14244.13-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

In order to obtain accurate estimates of the percentage points of the two sample t-like statistic, we use a Monte Carlo swindle based on the method of conditional probabilities. The formulas for this implementation are described in this report. GRA

N80-33161# Princeton Univ., N. J. Dept. of Statistics.
A ROBUST CONFIDENCE INTERVAL FOR SAMPLES OF FIVE OBSERVATIONS
Karen Kafadar Nov. 1979 27 p refs
(Grant DAAG29-76-G-0298)
(AD-A088071; TR-154-SER-2; ARO-14244.14-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A robust confidence interval using biweights for the case of five observations is proposed when the underlying distribution has somewhat heavier tails than the Gaussian. The distribution of a t-like statistic is approximated by a Student's t on the nominal four degrees of freedom using different scale factors which depend upon the value of the biweight weights. Results given by Monte Carlo simulations indicate that, even for very high coverage probabilities, the intervals proposed are highly efficient, in terms of the expected length of the confidence interval. GRA

N80-33162# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
A ROBUST ESTIMATOR OF THE DIFFERENCE BETWEEN LOCATION PARAMETERS OF CORRELATED VARIABLES FOR FRAGMENTARY SAMPLES Interim Report
L. J. Wei Apr. 1980 16 p refs
(Contract F49620-79-C-0140)
(AD-A088109; AFOSR-80-0569TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A simple and robust estimator of the difference of location parameters of correlated variables is proposed when some observations on either of the variables are missing. We show that this estimator is consistent, asymptotically normally distributed, and insensitive to outlying observations. Asymptotic relative efficiency comparisons with other known estimators are made to show the advantage of the proposed estimator. GRA

N80-33163# Iowa Univ., Iowa City. Dept. of Statistics.
LIKELIHOOD RATIO TESTS FOR AND AGAINST A STOCHASTIC ORDERING BETWEEN MULTINOMIAL POPULATIONS TESTS FOR A STOCHASTIC ORDERING
Tim Robertson and F. T. Wright 17 Jul. 1980 23 p refs
Prepared in cooperation with Missouri Univ., Rolla.
(Contracts N00014-80-C-0321; N00014-80-C-0322)
(AD-A088194; TR-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Likelihood ratio tests concerning the parameters of two multinomial populations are discussed. A stochastic ordering restriction is considered as a one sided alternative to equality. The one and two sample tests for equality versus stochastic ordering and stochastic ordering versus all alternatives are derived and their large sample distributions are obtained. The large sample distributions are mixtures of chi-squared distributions. The tests developed provide discrete analogues for the one sided Mann-Whitney-Wilcoxin and Kolmogorov-Smirnov tests. GRA

N80-33164# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
MORE ON APPROXIMATIONS OF POISSON PROBABILITIES

Chung-siung Kao May 1980 16 p refs Presented at the Am. Statist. Assoc. Ann. Meeting, Houston, Tex., 11-14 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27878; CONF-800820-3) Avail: NTIS HC A02/MF A01

Several approximation methods are stated and compared numerically. An approximation based on a power transformation is found to outperform those based on the square-root type transformation as proposed in literature. The traditional Wilson-Hilferty approximation and Makabe-Morimura approximation are extremely poor compared with this approximation. DOE

N80-33166# Oak Ridge National Lab., Tenn.
DECIDING ON THE BEST (IN THIS CASE) APPROACH TO TIME-SERIES FORECASTING
David J. Pack 1980 17 p refs Presented at Canadian Operations Res. Soc. Meeting, Quebec, 20 May 1980
(Contract W-7405-eng-26)
(CONF-800571-1) Avail: NTIS HC A02/MF A01

It is demonstrated that a totally empirical comparison of the adaptive estimation procedure and the Box-Jenkins methodology is quite misleading with respect to choosing between them. This demonstration is followed by a discussion on comparison-of-methods techniques. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-33168# Purdue Univ., Lafayette, Ind. Krannert Graduate School of Management.
A GENERALIZED DECISION SUPPORT SYSTEM USING PREDICATE CALCULUS AND NETWORK DATA BASE MANAGEMENT
Robert H. Bonczek, Clyde W. Holsapple (Illinois Univ., Urbana), and Andrew B. Whinston Jul. 1980 36 p refs
(Contract DAAG29-79-C-0154)
(AD-A088079; ARO-16231.5-EL) Avail: NTIS HC A03/MF A01 CSCL 12/2

In view of the growing prominence of corporate modeling, an important area of research concerns techniques for facilitating the design and utilization of models. In this paper, we show how first-order predicate calculus can be used as a language for formally stating modeling knowledge. Furthermore, knowledge stated in this manner can be subjected to the resolution principle. The result is that application specific modeling knowledge need not be embedded in a computer program. Rather, it can be stored in a data base and utilized as needed by a problem processing system employing resolution techniques. Advantages of a decision support system taking an approach of this sort are considerable modeling flexibility, capacity for automating the model formulation and execution processes, and compatibility with a high-level user interface language. GRA

N80-33167# Wayne State Univ., Detroit, Mich. Dept. of Mechanical Engineering.
BASIC RESEARCH IN ENGINEERING: PROCESS AND SYSTEMS DYNAMICS AND CONTROL HIGH PRIORITY RESEARCH NEEDS RELEVANT TO ENERGY
M. J. Rabins, T. F. Edgar (Texas Univ. at Austin), H. H. Richardson (MIT, Cambridge), and J. Zaborszky (Washington Univ., Seattle) Feb. 1980 162 p. refs Workshop held at Denver, 20-23 Jun. 1979; sponsored by Am. Automatic Control Council, ASME and Engineering Societies Commission on Energy, Inc.
(Contract EF-77-C-01-2468)
(FE-2468-65) Avail: NTIS HC A08/MF A01

Process and Systems Dynamics and Control (PSDC) is concerned with the development and control of system behavior, performance criteria, and theories of control and optimization. A set of high-priority basic engineering research needs in the PSDC field which are important to the development of future energy technologies. The ten high priority generic research areas were aggregated into four major research needs recommended for DOE support: on-line optimization and control, systems methodology, measurements methodology and instrumentation, and modeling. DOE

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-33169# Washington Univ., Seattle. Dept. of Mathematics.
QUALITATIVE MATRICES: STRONG SIGN-SOLVABILITY AND WEAK SATISFIABILITY
Victor Klee and Richard Ladner May 1980 37 p refs
(Contracts N00014-76-C-0423; N00014-67-A-0103; Grant NSF MCS-77-02474; NR Proj. 044-353)
(AD-A087686; TR-80-05-01; TR-69) Avail: NTIS HC A03/MF A01 CSCL 12/1

The study of 'qualitative' linear systems was suggested by Paul Samuelson in 1947 in his influential book on Foundations of Economic Analysis. The present paper deals with a rather general form of qualitative solvability, of which strong sign-solvability is a special case, and with a closely related notion, weak satisfiability, from propositional logic. The study of strong sign-solvability is reduced to that of s-matrices and a conjecture of T. Gorman on the structure of S-matrices is elucidated. An algorithm is described which uses linear programming methods to recognize S-matrices (and much more general systems) and thus solves this recognition problem is polynomial time. However, this is close to the boundary of NP-completeness, for the closely related problem of recognizing weak satisfiability is shown to be NP-complete. GRA

N80-33189# Texas Univ., Austin. Center for Particle Theory.
SUPRALGEBRAS, SUPERGROUPS AND GEOMETRIC GAUGING
Yuval Neeman Dec. 1979 42 p refs Submitted for publication Supported in part by the US-Israel Binational Science Foundation
(Contract DE-AS05-76ER-03992)
(ORO-3992-384) Avail: NTIS HC A03/MF A01

Superalgebras, supergroups, and supermanifolds are discussed under the following headings: supers enter physics and mathematics; superalgebras; superconformal and super-Poincare algebras; the Z(2) and Z graded Grassman rings: supermanifolds; the classification of simple Lie superalgebras; classical superalgebras; the orthosymplectic sequences; classical hyperexceptional and exceptional superalgebras; nonclassical superalgebras; and supergroups. Gauging a supergroup has yielded an embedding of the Weinberg-Salam model of asthenodynamics in a highly constraining aesthetic theory. In this part, dealing with forms on a (rigid) group manifold, a principal bundle, and a soft (Dali) group manifold, the elements of the exterior calculus are developed on a Lie group manifold. Then the geometric theory of gauging is obtained: for a local internal symmetry, this is done on a principal bundle. For a noninternal group, such as the Poincare or super-Poincare group, Gravity and Supergravity are reproduced by use of a soft group manifold. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-33170# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SELF-CONSISTENT MANY BODY THEORY FOR STANDARD BASIS OPERATOR GREEN'S FUNCTION: AN APPLICATION TO ANISOTROPIC FERROMAGNETS
R. Micnas, R. Kishore, and I. C. daCunhaLima Jul. 1980 10 p refs Presented at 32d SBPC Meeting
(INPE-1824-RPE/190) Avail: NTIS HC A02/MF A01

A self-consistent many body theory is used to obtain an exact Dyson type equation of the retarded Green's function for the standard basis operator. These Green's functions are used

to obtain elementary excitations and thermodynamic properties of the Heisenberg ferromagnet with uniaxial anisotropy. M.G.

N80-33171# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
MAGNETIC FIELD INTERACTIONS WITH MATERIAL DISCONTINUITIES Final Report, 15 Jun. 1976 - 15 Apr. 1980
William Lord Apr. 1980 48 p refs
(Grants DAAG29-76-G-0249; DAAG29-78-G-0143)
(AD-A084541; ARO-13279.5-MS) Avail: NTIS HC A03/MF A01 CSCL 14/5

Electromagnetic methods of nondestructive testing are discussed, detecting defects in metal parts. A major stumbling block in the development of these techniques, particularly with regard to the study of automated defect characterization schemes, is the lack of a suitable model capable of predicting the inherent complex field/defect interactions. The feasibility of applying finite element analysis techniques to the modeling of (1) active leakage field (2) residual leakage field and (3) eddy current methods of nondestructively testing metal structures is examined. The use of numerical analysis techniques shows the interrelationship of all the electromanetic nondestructive phenomena and the need for accurate material property (conductively and permeability) values. S.F.

N80-33172# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
CALCULATION OF THE BIOT-SAVART LAW MAGNETIC FIELD USING CURRENT DISTRIBUTIONS OBTAINED FROM A FINITE ELEMENT ANALYSIS
John W. Frye 27 Jul. 1980 32 p refs
(AD-A088094; NUSC-TR-6281) Avail: NTIS HC A03/MF A01 CSCL 20/3

Biot-Savart law magnetic field integration equations are derived for rod and plate elements, and for volume interface regions from an equation due to Wiksvo. These equations have applications for problems where current distributions are present over extended volumes and are calculated on the basis of a finite element electric field analysis. The Biot-Savart field so calculated can be used in a further finite element analysis of the magnetic field about a body of high permeability located in the same region as the electric field. GRA

N80-33173# Air Command and Staff Coll., Maxwell AFB, Ala.
THE FREE-BODY DIAGRAM REVISITED
Michael T. Toole May 1980 18 p refs Submitted for publication
(AD-A087952; ACSC-2500-80B) Avail: NTIS HC A02/MF A01 CSCL 20/11

The purpose of this article is to review and hopefully revive interest in a procedure, the use of the free-body diagram, which is useful to students in an introductory mechanics course. This article provides a detailed discussion of the free-body diagram with examples and integrates the free-body diagram in to the problem-solving process. GRA

N80-33174# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
A FUNCTIONAL FOR FINITE ELEMENT ANALYSIS OF LOW INTENSITY MAGNETIC FIELDS INCLUDING PERMANENT MAGNETIZATION EFFECTS
John W. Frye 17 Jun. 1980 9 p refs
(AD-A088230; NUSC-TR-6289) Avail: NTIS HC A02/MF A01 CSCL 20/3

A functional is presented that is useful in the finite element analysis of low intensity, static magnetic field solutions. The variational principle is written in terms of a scalar potential function and, when minimized, leads to field equations and boundary conditions that characterize a magnetic field, accounting for the presence of current, permanent magnetization, and incident magnetic fields. This variational principle finds applications in the finite element analysis of magnetic field problems. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-33175*# United Technologies Research Center, East Hartford, Conn.
AIRFRAME NOISE REDUCTION STUDIES AND CLEAN-AIRFRAME NOISE INVESTIGATION Final Report
Martin R. Fink and Douglas A. Bailey Apr. 1980 84 p refs
(Contract NAS1-15796)
(NASA-CR-159311; RBO-914626-12) Avail: NTIS HC A05/MF A01 CSCL 20A

Acoustic wind tunnel tests were conducted of a wing model with modified leading edge slat and trailing edge flap. The modifications were intended to reduce the surface pressure response to convected turbulence and thereby reduce the airframe noise without changing the lift at constant incidence. Tests were conducted at 70.7 and 100 m/sec airspeeds, with Reynolds numbers 1.5 x 10 to the 6th power and 2.1 x 10 to the 6th power. Considerable reduction of noise radiation from the side edges of a 40 deflection single slotted flap was achieved by modification to the side edge regions or the leading edge region of the flap panel. Total far field noise was reduced 2 to 3 dB over several octaves of frequency. When these panels were installed as the aft panel of a 40 deg deflection double slotted flap, 2 dB noise reduction was achieved. R.C.T.

N80-33176*# Aeronautical Research Associates of Princeton, Inc., N. J.
VISCOUS THEORY OF SURFACE NOISE INTERACTION PHENOMENA Final Report
John E. Yates Sep. 1980 44 p refs
(Contract NAS1-15539)
(NASA-CR-3331; ARAP-419) Avail: NTIS HC A03/MF A01 CSCL 20A

A viscous linear surface noise interaction problem is formulated that includes noise production by an oscillating surface, turbulent or vortical interaction with a surface, and scattering of sound by a surface. The importance of viscosity in establishing uniqueness of solution and partitioning of energy into acoustic and vortical modes is discussed. The results of inviscid two dimensional airfoil theory are used to examine the interactive noise problem in the limit of high reduced frequency and small Helmholtz number. It is shown that in the case of vortex interaction with a surface, the noise produced with the full Kutta condition is 3 dB less than the no Kutta condition result. The results of a study of an airfoil oscillating in a medium at rest are discussed. It is concluded that viscosity can be a controlling factor in analyses and experiments of surface noise interaction phenomena and that the effect of edge bluntness as well as viscosity must be included in the problem formulation to correctly calculate the interactive noise. A.R.H.

N80-33177*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
MODAL CONTENT OF NOISE GENERATED BY A COAXIAL JET IN A PIPE
E. J. Kerschen and J. P. Johnston May 1978 271 p refs
(Grants NsG-2007; NSF GK-37294; NSF ENG-76-00819)
(NASA-CR-163575; SU-JIAA-TR-11) Avail: NTIS HC A12/MF A01 CSCL 20A

Noise generated by air flow through a coaxial obstruction in a long, straight pipe was investigated with concentration on the modal characteristics of the noise field inside the pipe and downstream of the restriction. Two measurement techniques were developed for separation of the noise into the acoustic duct modes. The instantaneous mode separation technique uses four microphones, equally spaced in the circumferential direction, at the same axial location. The time-averaged mode separation technique uses three microphones mounted at the same axial location. A matrix operation on time-averaged data produces the modal pressure levels. This technique requires the restrictive assumption that the acoustic modes are uncorrelated with each other. The measured modal pressure spectra were converted to modal power spectra and integrated over the frequency range

200-8000 Hz. The acoustic efficiency levels (acoustic power normalized by jet kinetic energy flow), when plotted vs. jet Mach number, showed a strong dependence on the ratio of restriction diameter to pipe diameter. The acoustic energy flow analyses based on the thermodynamic energy equation and on the results of Mohring both resulted in orthogonality properties for the eigenfunctions of the radial mode shape equation. These orthogonality relationships involve the eigenvalues and derivatives of the radial mode shape functions. F.O.S.

N80-33178# Utah Univ., Salt Lake City. Dept. of Computer Science.
A CONSTANT PERCENTAGE BANDWIDTH TRANSFORM FOR ACOUSTIC SIGNAL PROCESSING
James E. Youngberg Jan. 1980 121 p refs
(Contract N00173-79-C-0045)
(AD-A085868; UTEC-CS-80-004) Avail: NTIS HC A06/MF A01 CSCL 20/1

A constant percentage bandwidth transform for acoustic signal processing is described. A synthesis transformation is developed which, cascaded with the analysis transformation provides an analysis-synthesis identity in the absence of spectral modification. The effects of spectral domain modification are described. Principles governing discrete implementation of the transform pair are discussed, and relationships are formalized which specify minimal sample requirements for the spectral domain. The Constant-Q spectral magnitude and phase functions are discussed, and three main methods are evaluated whereby the spectral requirements be unwrapped. The use of the transform pair is discussed in the solution of the perception related problem of time scale compression and expansion of speech. R.C.T.

N80-33179# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL STUDIES OF IMPULSIVE NOISE PRODUCED BY SPHERES MOVING THROUGH WATER M.S. Thesis
Thomas Kunze Mar. 1980 64 p refs
(AD-A084419) Avail: NTIS HC A04/MF A01 CSCL 20/1

Spheres were towed in an anechoic tank. Velocities up to 5 m/sec and Reynolds numbers up to 500,000 were obtained with spheres of 2, 4, and 10 in diameter. After eliminating all mechanical and acoustical disturbances, no noise bursts were detected. However, the impulsive noise was still observed in free-fall experiments, and a ranging system allowed the location of these noise bursts with respect to a fixed point. A frequency analysis was done with a digital signal processor. T.M.

N80-33180# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
SCATTERING MATRIX ANALYSIS OF SURFACE ACOUSTIC WAVE REFLECTIONS AND TRANSDUCERS Ph.D. Thesis
Carl Michael Panasik Feb. 1980 70 p refs
(Contracts F19628-78-C-0040; N00014-79-C-0424)
(AD-A085764; UILU-ENG-80-2205; R-873) Copyright. Avail: NTIS HC A04/MF A01 CSCL 20/1

The phased periodic array scattering parameters were modified and corrected for use as a single electrode, mixed units, scattering matrix consisting of one electrical and two acoustic port. These scattering parameter analytical expressions are functions of material constants, electrode geometry, and frequency. The three port single electrode scattering matrices are acoustically cascaded to produce a three port device scattering matrix which takes into account all finger interactions (acoustic and electric) for the combined effects of piezoelectric and mechanical scattering. The analysis agrees well with experimental measurements of input admittance, electro-acoustic transfer function, and acoustic transmission and reflection coefficients as functions of frequency. Analysis results for the complete modeling of transducers with floating electrodes are also presented. Author

N80-33181# Texas Univ. at Austin. Applied Research Labs.
SIGNAL PROCESSING ASPECTS OF NONLINEAR ACOUSTICS
T. G. Muir and Tommy G. Goldsberry 7 Jul. 1980 37 p refs Presented at the NATO Advan. Study Inst. on Underwater Acoustics and Signal Process., Copenhagen, 18-29 Aug. 1980
(Contract N00014-75-C-0161)
(AD-A088369; ARL-TR-80-38) Avail: NTIS HC A03/MF A01 CSCL 20/1

The topic of nonlinear acoustics has been included at previous NATO study institutes going back to 1966. The first treatment, by Berktay, speculated on the possibilities nonlinear effects might offer. In 1968, Mellen illustrated some of these possibilities through laboratory tank experiments. Berktay returned in 1972 to present some engineering models for the design of parametric sources. In 1976, Bjorno presented a survey of theoretical and experimental results on parametric arrays developed at several laboratories. Today, research and development in nonlinear acoustics has gravitated toward applications. The present paper therefore addresses applications with a view towards outlining the unique features of nonlinear arrays, especially with regard to signal processing. Both nonlinear sources and receivers will be discussed. GRA

N80-33182# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif. Biodynamics and Bioengineering Div.
DEVELOPMENT OF NOISECHECK TECHNOLOGY FOR MEASURING AIRCRAFT NOISE EXPOSURE Final Report
Peter E. Rentz May 1980 140 p refs
(Contract F33615-77-C-0514; AF Proj. 7231)
(AD-A088033; BBN-3862; AMRL-TR-78-125) Avail: NTIS HC A07/MF A01 CSCL 14/2

This report describes a program to develop instrumentation for use by Air Force personnel to make spot checks of the noise exposure at locations in and about air bases. These instruments combined with standardized field measurement procedures form a technology, termed NOISECHECK, which provides a means for measuring the noise environment and checking daily average noise level values (DNL's) calculated by the Air Force NOISEMAP community-aircraft noise prediction program. GRA

N80-33183# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
STUDY OF LATERAL EXCESS SOUND ATTENUATION AS DETERMINED FROM FAR PART 36 AIRCRAFT NOISE CERTIFICATION MEASUREMENTS
Dwight E. Bishop and Jane M. Beckmann Wright-Patterson AFB, Ohio Air Force Aerospace Medical Research Lab. Jul. 1980 58 p refs
(Contract F33615-79-C-0501; AF Proj. 7231)
(AD-A088285; BBN-4225; AFAMRL-TR-80-65) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report presents information on the variation of the lateral excess attenuation as a function of elevation angle. Lateral excess attenuation represents the differences between the noise levels measured directly underneath the aircraft and to the side of the aircraft, after adjustment for differences in distance and air absorption. This information was developed from analysis of 'takeoff' and 'sideline' noise data acquired during FAR 36 civil aircraft noise certification tests. The study shows that useful excess attenuation information can be developed from aircraft certification data provided steps are taken to locate sideline positions so that measurements adequately cover the range of low elevation angles. The measured excess attenuation values show trends with frequency that are consistent with measurements observed in recent Air Force tests in the frequency range up to about 400 Hz. Larger excess attenuation values were measured at higher frequencies for reasons that are not known at this time. The perceived noise level (PNL), and A-level (AL), curves for each of the aircraft were generally similar in shape however the excess attenuation values for PNL were slightly larger than the AL values, with the difference most pronounced for the C-130H aircraft. GRA

N80-33184# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 119: C-135B AIRCRAFT, NEAR AND FAR-FIELD NOISE
Robert G. Powell Dec. 1979 149 p
(AF Proj. 7231)
(AD-A087953; AFAMRL-TR-75-50-Vol-119) Avail: NTIS HC A07/MF A01 CSCL 01/2

The USAF C-135B is a long range, high performance, transport aircraft powered by four TF33-P-5 turbofan engines. This report

provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for six engine/power configurations. Near-field data are reported for eleven locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N80-33185# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

COMPUTER PROGRAM TO ADD NOISEMAP GRIDS OF DIFFERENT SPACINGS Final Report

Harry Seidman Apr. 1980 31 p

(Contract F33615-79-C-0501; AF Proj. 7231)

(AD-A088205; AMRL-TR-79-88) Avail: NTIS HC A03/MF A01 CSCL 09/2

Noise data for normal aircraft operations are usually calculated by the NOISEMAP computer program at grid points 1000 feet apart. Data from blast noise and supersonic aircraft are calculated at grid points several thousand feet apart. This report describes a computer program that was written to allow the two sets of data to be combined. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-33186* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HYDROGEN HOLLOW CATHODE ION SOURCE Patent

Michael J. Mirtich, Jr., James S. Sovey, and Robert F. Roman, inventors (to NASA) Issued 19 Aug. 1980 4 p Filed 23 Oct. 1978 Supersedes N79-10894 (17 - 01, p 0118)

(NASA-Case-LEW-12940-1; US-Patent-4,218,633; US-Patent-Appl-SN-953391; US-Patent-Class-313-362; US-Patent-Class-313-231.4) Avail: US Patent and Trademark Office CSCL 20H

A source of hydrogen ions is disclosed and includes a chamber having at one end a cathode which provides electrons and through which hydrogen gas flows into the chamber. Screen and accelerator grids are provided at the other end of the chamber. A baffle plate is disposed between the cathode and the grids and a cylindrical baffle is disposed coaxially with the cathode at the one end of the chamber. The cylindrical baffle is of greater diameter than the baffle plate to provide discharge impedance and also to protect the cathode from ion flux. An anode electrode draws the electrons away from the cathode. The hollow cathode includes a tubular insert of tungsten impregnated with a low work function material to provide ample electrons. A heater is provided around the hollow cathode to initiate electron emission from the low work function material.

Official Gazette of the U.S. Patent and Trademark Office

N80-33187*# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.

ELECTRON-TEMPERATURE DEPENDENCE OF DISSOCIATIVE RECOMBINATION OF ELECTRONS WITH CO(+)-(CO) n-SERIES IONS

Martin Whitaker, Manfred A. Biondi, and Rainer Johnsen [1980] 16 p refs

(Grant NGL-39-011-137; Contract DAAG29-80-C-0075)

(NASA-CR-163572) Avail: NTIS HC A02/MF A01 CSCL 20H

A microwave afterglow mass spectrometer apparatus is used to determine the dependence on electron temperature T sub e of the recombination coefficients alpha sub n of the dimer and trimer ions of the series CO+(CO) sub n. It is found that alpha sub 1 = (1.3 + or - 0.3)x 0.000001 (T sub e(K)/300) to the -0.34; and alpha sub 2 = (1.9 + or - 0.4)x 0.000001 (T sub e(K)/300) to the -0.33 cu cm/sec. These dependences on T sub e are quite different from those obtained previously for polar-cluster ions of the hydronium and ammonium series but are similar to that for simple diatomic ions. M.G.

N80-33188*# California Univ., Santa Barbara.

ION CHEMISTRY IN INTERSTELLAR SPACE Final Report

Michael T. Bowers 30 Sep. 1980 4 p refs

(Contracts NAS7-100; JPL-955823)

(NASA-CR-163580; JPL-9950-417) Avail: NTIS HC A02/MF A01 CSCL 20H

The temperature dependence of the bimolecular reactions of Cl(+), HCl(+), CH(+), CH2(+), N(+), NH(+), and NH2(+) reacting with H2 have been investigated. For Cl(+) and HCl(+) rate constants have been determined over the temperature range of 150 to 400 K. Preliminary data have been obtained for the other systems. The Cl(+)/H2 system shows a weak, but significant positive temperature dependence that could be important in interstellar modeling studies. The HCl(+)/H2 system shows a substantial negative temperature dependence with the rate constant approaching the collision rate at low temperatures. The association reaction CH3(+) + HCN yields CH3 HCN(+) has been theoretically modeled using statistical phase space theory. Both radiative and collisional stabilization have been included. The results are compared with experiment with good agreement obtained over wide variations in T and p. This system is potentially important in the mechanism of large molecule synthesis in interstellar space. Author

N80-33189# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

INFLUENCE OF ION MOTION IN THE INVERSE FARADAY EFFECT

Abraham C.-L. Chian Jun. 1980 12 p refs Presented at the 32d Reuniao Anual da Soc. Brasileira para o Progr. da Cienc. Submitted for publication

(INPE-1764-RPE/153) Avail: NTIS HC A02/MF A01

It is shown that ion motion can significantly affect the magnetic field generated by an intense circularly polarized electromagnetic wave in a plasma. For extremely strong waves, the magnetic field induced by the electron current in an electron-ion plasma can be nearly cancelled by the ion current. Author

N80-33190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TABLES OF STARK LEVEL TRANSITION PROBABILITIES AND BRANCHING RATIOS IN HYDROGEN-LIKE ATOMS

K. Omidvar Sep. 1980 50 p refs Submitted for publication

(NASA-TM-82015) Avail: NTIS HC A03/MF A01 CSCL 20H

The transition probabilities which are given in terms of n prime k prime and n k are tabulated. No additional summing or averaging is necessary. The electric quantum number k plays the role of the angular momentum quantum number l in the presence of an electric field. The branching ratios between stark levels are also tabulated. Necessary formulas for the transition probabilities and branching ratios are given. Symmetries are discussed and selection rules are given. Some disagreements for some branching ratios are found between the present calculation and the measurement of Mark and Wierl. The transition probability multiplied by the statistical weight of the initial state is called the static intensity J sub S, while the branching ratios are called the dynamic intensity J sub D. R.K.G.

N80-33191*# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.

DYNAMICS OF THE CHEMISTRY OF ELECTRONICALLY EXCITED ATOMS IN DEFINED QUANTUM STATES Final Report, 1 Apr. 1975 - 31 May 1980

John R. Wiesenfeld 15 Aug. 1980 15 p refs

(Contract N00014-75-C-0828; NR Proj. 394-010)
(AD-A088117) Avail: NTIS HC A02/MF A01 CSCL 07/4

The work described here involved the study of halogen atom production and removal following photodissociation of halogens, pseudohalogens and halides. Both collisional quenching and chemical reaction were seen. Electronic angular momentum conservation led to state-selective chemistry. GRA

N80-33192# Nebraska Univ., Lincoln.
PHOTOIONIZATION OF ATOMS Progress Report, 1 Apr. 1979 - 30 Mar. 1980
J. A. R. Samson and A. F. Starace Dec. 1979 26 p refs
(Contract DE-AS02-76ER-02892)
(COO-2892-18) Avail: NTIS HC A03/MF A01

A strong 304 A fluorescent signal from He(+) (n = 2) was observed as a function of incident photon wavelength; strong autoionizing structure arising from 3n(+) states are seen in the spectrum. Measurements of the radio of photoproduced Ne(+) ions to Ne(2+) ions indicate that further calibration of detector response is required. The dissociative photoionization of O2 was measured successfully as a necessary preliminary to measuring the photoionization cross section of atomic oxygen. Experimental apparatus was built to measure the photoelectron angular distribution of atomic cesium. In order to measure rare gas photoionization cross sections to plus or minus 1 percent accuracy, a new gas tight window was developed and second order lines in the laboratory light sources were classified. A new random phase approximation for the theoretical calculation of open or closed shell atom photoionization cross sections was developed. DOE

N80-33193# Washington Univ., Seattle. Dept. of Physics.
TECHNIQUE FOR MEASURING PARITY NONCONSERVATION IN HYDROGENIC ATOMS
E. G. Adelberger, T. A. Trainor, E. N. Fortson, T. E. Chupp, D. Holmgren, M. Z. Iqbal, and H. E. Swanson 1979 21 p refs
(Contract DE-AC06-76ER-01388)
(DOE/ER-01388-444; RLO-1388/444) Avail: NTIS HC A02/MF A01

A scheme for precise measurement of the parity mixing of the 2s/sub 1/2/ and 2p/sub 1/2/ states is discussed. The mixing was in hydrogen and deuterium atoms. DOE

N80-33194# Sandia Labs., Albuquerque, N. Mex.
INTERACTIONS BETWEEN SMALL POLARONIC PARTICLES IN SOLIDS
David Emin 1980 5 p refs Presented at Intern. Conf. on the Phys. of MOS Insulators, Raleigh, N.C., 18 Jun. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0486C; CONF-800647-1) Avail: NTIS HC A02/MF A01

The interaction between strongly coupled particles (or quasiparticles) which results from their mutual interaction with the atomic displacements of the host material is examined. As examples, the recombination kinetics of electron and hole small polarons and the ordering of defect atoms are discussed. DOE

N80-33195# Brookhaven National Lab., Upton, N. Y.
THREE DIMENSIONAL CALCULATION OF ELECTRON ENERGY LOSS IN A VARIABLE PARAMETER FREE-ELECTRON LASER
A. Luccio and C. Pellegrini Mar. 1980 30 p refs
(Contract EY-76-C-02-0016)
(BNL-27598) Avail: NTIS HC A03/MF A01

The effect on the laser efficiency of the electron transverse motion is studied and the electron energy loss is evaluated for a beam having a spread in angle and in the transverse position at the wiggler entrance. The complete three dimensional equations of motion for an electron interacting with the laser field and the wiggler field are integrated numerically. Only the case of a small gain regime, assuming that the laser field intensity remains constant, is considered. The case of a helical wiggler is specifically addressed. The results are compared with the one dimensional model. The effect of the initial position and angular spread can, to a good approximation, be considered equivalent to an increase in the energy spread. The limits for this increased energy spread that must not be exceeded in order to avoid a loss in efficiency are nearly the same as in the one dimensional model. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see 93 *Space Radiation*.

N80-33196# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
PROCEEDINGS OF THE PARTICLE BEAM RESEARCH WORKSHOP
B. D. Guenther, Robert Lontz, John L. May (AFOSR, Washington, D.C.), and C. Martin Stickley Office of the Undersecretary of Defense, May 1980 101 p Workshop held at Colorado Springs, 10-11 Jan. 1980
(AD-A085158) Avail: NTIS HC A06/MF A01 CSCL 20/8

The particle beam research workshop was organized to develop a forum for the discussion of unclassified research issues relevant to particle beam weapons technology, and to develop a document which could be used as an unclassified guide for scientists who are interested in this technology but have not had prior access to the classified efforts. Finally, the workshop and the guide are designed to provide an information resource for DoD managers concerned with the opportunities that unclassified research offer to this technology. Author

N80-33197# Naval Research Lab., Washington, D. C.
DIOCOTRON INSTABILITY OF A RELATIVISTIC COAXIAL MULTI-RING HOLLOW ELECTRON BEAM
H. C. Chen and P. J. Palmadesso 18 Aug. 1980 30 p refs
(AD-A088054; NRL-MR-4286) Avail: NTIS HC A03/MF A01 CSCL 20/7

The diocotron stability properties of a relativistic coaxial multiring hollow electron beam are investigated using a macroscopic cold fluid description based on moment-Maxwell equations. It is found that for a broad range of beam parameters and somewhat more general type beam profile the growth rate of instability has a sensitive dependence on fractional charge neutralization, relative position of the rings with conducting wall and gap-length of the rings. In the case of a sharp boundary density profile, the beam can be stabilized easily by a small fractional charge neutralization with appropriate gap length. The growth rate can be either enhanced or reduced depending on the position and gap length of the rings. GRA

N80-33198# Oak Ridge National Lab., Tenn.
ION ENERGY RECOVERY EXPERIMENT BASED ON MAGNETIC ELECTRO SUPPRESSION
J. Kim, W. L. Stirling, W. K. Dagenhart, G. C. Barber, and N. S. Ponte May 1980 32 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7283) Avail: NTIS HC A03/MF A01

A proof of principle experiment on direct recovery of residual hydrogen ions based on a magnetic electron suppression scheme is described. Ions extracted from a source plasma a few kilovolts above the ground potential (approximately 20 A) are accelerated to 40 keV by a negative potential maintained on a neutralizer gas cell. As the residual ions exit the gas cell, they are deflected from the neutral beam by a magnetic field that also suppresses gas cell electrons and then recovered on a ground potential surface. Under optimum conditions, a recovery efficiency (the ratio of the net recovered current to the available full energy ion current) of 80% + or - 20% was obtained. Magnetic suppression of the beam plasma electrons was rather easily achieved; however, handling the fractional energy ions originating from molecular species (H2(+) and H3(+)) proved to be extremely important to recovery efficiency. DOE

N80-33199# Department of Energy, Aiken, S.C. Savannah River Operations Office.
RERACKING TO INCREASE SPENT FUEL STORAGE CAPACITY, REVISION 1
May 1980 12 p ref
(DOE/SR/SF-2004-Rev-1) Avail: NTIS HC A02/MF A01

Many utilities increased their spent fuel pool storage capacity by replacing aluminum racks having storage densities as low as 0.2 MTU/sq ft with stainless steel racks which can more than

double storage densities. Use of boron-stainless steel racks or thin stainless steel cans containing reassembled fuel rods allows even higher fuel storage densities (up to approximately 1.25 MTU/sq ft). The economics of smaller storage gains that occur if pools, already converted to high density storage, are further reracked are evaluated. DOE

N80-33200# Department of Energy, Washington, D. C. Office of Inertial Fusion.
HEAVY ION BEAMS FOR INERTIAL FUSION
T. F. Godlove and William B. Herrmannsfeldt May 1980 11 p refs Presented at the Intern. Conf. on Low Energy Ion Beams 2, Bath, England, 14-17 Apr. 1980 Prepared in cooperation with the Stanford Linear Accelerator Center, Calif.
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2524; CONF-800466-3) Avail: NTIS HC A02/MF A01

The United States' program in inertial confinement fusion (ICF) is described, with emphasis on the studies of the use of intense high energy beams of heavy ions to provide the power and energy needed to initiate thermonuclear burn. Preliminary calculations of the transport of intense ion beams in an electrostatic quadrupole focussing structure are discussed. DOE

N80-33201# Stanford Linear Accelerator Center, Calif.
INERTIAL CONFINEMENT FUSION SYSTEMS USING HEAVY ION ACCELERATORS AS DRIVERS
W. B. Herrmannsfeldt, T. F. Godlove (DOE), and D. Keffe (California Univ., Berkeley. Lawrence Berkeley Lab.) Mar. 1980 20 p refs Presented at the 2nd Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 8 Apr. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-Pub-2490; LBL-10870; CONF-800446-3) Avail: NTIS HC A02/MF A01

Heavy ion accelerators are of interest because of the expected efficient coupling of ion kinetic energy to the thermal energy needed to implode the pellet and because of the good electrical efficiency of high intensity particle accelerators. The beam intensities required, while formidable, lie within the range that can be studied by extensions of the theories and the technology of modern high energy accelerators. DOE

N80-33202# California Univ., Livermore. Lawrence Livermore Lab.
RECENT DEVELOPMENTS IN NUCLEAR REACTION THEORIES AND CALCULATIONS
D. G. Gardner 5 May 1980 35 p refs Presented at Symp. on Neutron Cross Sect. from 10 to 50 MeV, Upton, N.Y., 12 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84369; CONF-800551-11) Avail: NTIS HC A03/MF A01

Recent developments in the fields of optical model potentials; level densities; and statistical mode, precompound, and direct reaction codes and calculations are reviewed. Significant developments which will greatly enhance the ability to calculate high-energy neutron-induced reaction cross sections in the next few years are presented. DOE

N80-33203# Battelle Pacific Northwest Labs., Richland, Wash. Nuclear Waste Technology Program.
NUCLEAR WASTE MANAGEMENT Quarterly Progress Report, Oct. - Dec. 1979
A. M. Platt, comp. and J. A. Powell, comp. Apr. 1980 101 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RLO-1830)
(PNL-3000-4) Avail: NTIS HC A06/MF A01

Progress and activities are reported on the following: highlevel waste immobilization; alternative waste forms; nuclear waste materials characterization; TRU waste immobilization programs; TRU waste decontamination krypton solidification, thermal outgassing, and iodine-129 fixation along with monitoring of unsaturated zone transport, well-logging instrumentation development, and mobile organic complexes of fission products, waste management system and safety studies, assessment of effectiveness of geologic isolation systems, waste/rock interactions technology, spent fuel and fuel pool integrity program, and engineered barriers which are also discussed. DOE

N80-33204# California Univ., Livermore. Lawrence Livermore Lab.
FUSION PRODUCT DEPOSITION AND ENERGY BALANCE
W. C. Condit and D. E. Driemeyer (Illinois Univ., Urbana) 20 May 1980 8 p
(Contract W-7405-eng-48)
(UCID-18710) Avail: NTIS HC A02/MF A01

Monte Carlo calculations were performed of alpha particle deposition in the Hill's Vortex configuration, including a cold plasma density, n sub c, on the open field lines, with n sub C/T sub C(sup 3/2), approximately equal to n sub H/T sub H(sup 3/2) - i.e., with the slowing down ratio tau sub H/tau sub C/ lying between .1 and 10. Since many of the alpha particles spend a significant amount of their time on the open field lines, values of tau sub H/tau sub C greater than unity lead to significant removal of alpha particle ash from the closed field region. DOE

N80-33205# Brookhaven National Lab., Upton, N. Y.
FUSION: AN ENERGY SOURCE FOR SYNTHETIC FUELS
J. A. Fillo, J. Powell, and M. Steinberg 1980 9 p refs Presented at the AIAA Intern. Meeting and Tech. Display, Global Tech. 2000, Baltimore, 6-8 May, 1980
(Contract DE-AC02-76CH-00016)
(BNL-27891; CONF-800590-1) Avail: NTIS HC A02/MF A01

An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of approximately 40 to 60 percent and hydrogen production efficiencies by high temperature electrolysis of approximately 50 to 70 percent are projected for fusion reactors using high temperature blankets. Fusion/coal symbiotic systems appear economically promising for the first generation of commercial fusion synfuels plants. Coal production requirements and the environmental effects of large scale coal usage would be greatly reduced by a fusion/coal system. DOE

N80-33206# Arizona Univ., Tucson.
HYDROGEOLOGIC EFFECTS OF NATURAL DISRUPTIVE EVENTS ON NUCLEAR WASTE REPOSITORIES
S. N. Davis Jun. 1980 41 p refs
(Contract DE-AC06-76RL-01830)
(PNL-2858) Avail: NTIS HC A03/MF A01

Some possible hydrogeologic effects of disruptive events that may affect repositories for nuclear waste are described. A very large number of combinations of natural events can be imagined, but only those events which are judged to be most probable are covered. The disruptive events discussed above are placed into four geologic settings. The geology was generalized from actual field data. The geologic settings considered are: (1) interior salt domes of the Gulf Coast, (2) bedded salt of southeastern New Mexico, (3) argillaceous rocks of southern Nevada, and (4) granitic stocks of the Basin and Range Province. Log-normal distributions of permeabilities of rock units are given for each region. Discussions are devoted to: porosity and permeability of natural materials, regional flow patterns, disruptive events (faulting, dissolution of rock forming minerals, fracturing from various causes, rapid changes of hydraulic regimen); possible hydrologic effects of disruptive events; and hydraulic fracturing. DOE

N80-33207# California Univ., Livermore. Lawrence Livermore Lab.
FUSION MATERIALS HIGH ENERGY-NEUTRON STUDIES Status Report
D. G. Doran and M. W. Guinan (California Univ., Livermore, Lawrence Livermore Lab.) 1980 36 p refs Presented at the Symp. on Neutron Cross Sect. from 10-50 MeV, Upton, N.Y., 12 May 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2145-FP; CONF-800551-14) Avail: NTIS HC A03/MF A01

The US Magnetic Fusion Reactor Materials Program provides a framework for evaluating nuclear data needs associated with high energy neutron irradiations and the current status of relevant high energy neutron studies. Cross section development, source description, shielding, and activation are discussed. Dosimetry

cross sections have been tentatively extrapolated to 40 MeV. Extensive total helium measurements were made in a variety of neutron spectra. DOE

N80-33208# California Univ., Livermore. Lawrence Livermore Lab.
NEW CONCEPT FOR A HIGH-POWER BEAM DUMP
Ralph W. Moir and Clyde E. Taylor 16 Apr. 1980 7 p refs Presented at the Natl. Heat Transfer Conf., Orlando, Fla. Aug. 1980 Submitted for Publication
(Contract W-7405-eng-48)
(UCRL-83696; CONF-800818-1) Avail: NTIS HC A02/MF A01

A concept for a dump for the ion and neutral beams used in the controlled nuclear fusion program use thin sheets of a refractory metal such as tungsten formed into troughs having semicircular cross sections. High velocity water flowing circumferentially removes heat by subcooled nucleate boiling. Possible advantages are modular construction, lower water-pumping power, and a lower pressure drop than in conventional beam dumps. An example design calculation is shown for a dump capable of absorbing an incident flux of 10 kW/ sq cm. DOE

N80-33209# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
MATERIALS STUDIES FOR MAGNETIC FUSION ENERGY APPLICATIONS AT LOW TEMPERATURES, 3
R. P. Reed, ed. Jun. 1980 392 p refs Presented at 3d NBS/DOE Vail Workshop, Oct. 1979 Sponsored by DOE
(PB80-191497; NBSIR-80-1627) Avail: NTIS HC A17/MF A01 CSCL 18A

The evaluation of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on the nitrogen-strengthened stainless steels is discussed. Aluminum alloys received some consideration. The production and standardization of nonmetallics, primarily industrial laminates, for low temperature applications were considered. GRA

74 OPTICS

Includes light phenomena.

N80-33210* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTISPECTRAL SCANNER OPTICAL SYSTEM Patent
Roy C. Stokes (Lockheed Electronics Co., Houston, Tex.) and Norman G. Koch, inventors (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 29 Jul. 1980 8 p Filed 29 Mar. 1979 Supersedes N79-22880 (17 - 13, p 1775) Sponsored by NASA
(NASA-Case-MSC-18255-1; US-Patent-4,215,273; US-Patent-Appl-SN-025163; US-Patent-Class-250-347; US-Patent-Class-250-352; US-Patent-Class-250-353; US-Patent-Class-350-55; US-Patent-Class-356-72) Avail: US Patent and Trademark Office CSCL 20F

An optical system for use in a multispectral scanner of the type used in video imaging devices is disclosed. Electromagnetic radiation reflected by a rotating scan mirror is focused by a concave primary telescope mirror and collimated by a second concave mirror. The collimated beam is split by a dichroic filter which transmits radiant energy in the infrared spectrum and reflects visible and near infrared energy. The long wavelength beam is filtered and focused on an infrared detector positioned in a cryogenic environment. The short wavelength beam is dispersed by a pair of prisms, then projected on an array of detectors also mounted in a cryogenic environment and oriented at an angle relative to the optical path of the dispersed short wavelength beam.
Official Gazette of the U.S. Patent and Trademark Office

N80-33211*# ITT Electro-Optical Products Div., Fort Wayne, Ind.
CIRCULAR SCAN STREAK TUBE DEVELOPMENT Final Technical Report, May 1976 - Mar. 1979
Scott Nevin Jul. 1980 48 p refs
(Contract NAS5-23525)
(NASA-CR-160029) Avail: NTIS HC A03/MF A01 CSCL 20F

A streak tube having circular scan was designed, built and tested. Continuous circular scan, easily derived from out of phase sine waves applied to the conventional deflection plates, permits the timing of pulses traveling long baselines. At the tube's output a circular array of 720 elements is scanned to provide 30 to 40 picosecond resolution. Initial difficulties with electron bombarded silicon arrays were circumvented by using microchannel plates within the streak tube to provide the needed electronic amplification and digital sensitivity and coupling the 720 element arrays to the electron beam by means of a phosphor on a fiber optics. Two ceramic body tubes with S-20 photocathodes were tested and delivered. Author

N80-33212# Honeywell Systems and Research Center, Minneapolis, Minn.
ADVANCED PATTERN-MATCHING TECHNIQUES FOR AUTONOMOUS ACQUISITION Quarterly Progress Report, 23 Nov. 1979 - 23 Feb. 1980
P. M. Narendra and J. J. Grabau Mar. 1980 105 p
(Contract DAAK70-79-C-0114)
(AD-A087684; HONEYWELL-BOSRC25; QPR-2) Avail: NTIS HC A06/MF A01 CSCL 17/7

The key objective of this effort is the development of pattern-matching algorithms which can impart autonomous acquisition capability to precision-guided munitions such as Copperhead and Hellfire. Autonomous acquisition through pattern matching holds the promise of eliminating laser designation and enhancing fire power by multiple target prioritization. The pattern-matching approach being developed under this program is based on a symbolic pattern-matching framework, which is suited for the autonomous acquisition scenario. It is based on matching a symbolic representation derived from the two images, and it can accommodate the stringent pattern-matching criteria established by the scenario: enormous differences in sensor characteristics and illumination, and scene changes such as target motion and obscuration from one view point to the other. GRA

N80-33213# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL RESTORATION OF AC-COUPLED INFRARED IMAGES
R. J. Becherer and B. A. Capron 1979 10 p refs
(Contract F19628-80-C-0002)
(AD-A085430; ESD-TR-79-346) Avail: NTIS HC A02/MF A01 CSCL 14/5

A simple digital recursion relation was developed to restore images which were degraded by the AC coupling characteristics of infrared imaging sensors. The recursion relation is derived and shown to be equivalent to inverse filtering. To indicate the magnitude of the distortion due to AC coupling the RMS deviation between input and output signals is calculated for a single rectangular pulse and a series of rectangular pulses. Examples of images before and after the recursive restoration process are shown. Author

N80-33214# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED OPTICAL PROPERTIES OF THIN CO, NO, CH4, HC1, N2O, O2, AR, AND AIR CRYOFILMS Final Report, 1 Oct. 1978 - 1 Sep. 1979
J. A. Roux, B. E. Wood, A. M. Smith, and R. R. Plyer AEDC Aug. 1980 87 p refs
(AD-A088269; AEDC-TR-79-81) Avail: NTIS HC A05/MF A01 CSCL 07/5

The infrared spectral transmittance of cryofilms formed by CO, NO, CH4, HC1, N2O, O2, N2, Ar, and air were measured. These films were condensed on a 20 K germanium substrate and ranged in thickness from 0.25 to 15 micrometer; the deposition pressure for the films was 2 x 10 to the -7th power torr. Transmission spectra were obtained for the 500- to 3700/cm wavenumber range using a Fourier transform spectrometer. Values of complex index of refraction (n - n - ik) for the cryodeposits were derived from the experimental data using an analytical model and the nonlinear least-squares method. The analytical model treats the germanium as a thick noninterfering film and the deposit as a thin film. Results from the least-squares method are also compared with a Kramers-Kronig determination of the

real part of the index of refraction. The optical properties (n,k) of such cryofilms are required for predicting the degradation of contaminated, cryogenically cooled optical surfaces. GRA

N80-33215# Naval Ocean Systems Center, San Diego, Calif.
INTEGRATED OPTICAL LOGIC GATES. A DEMONSTRATION OF FOUR OPTICAL LOGIC FUNCTIONS Independent Research Report, Dec. 1977 - Sep. 1978
M. J. Taylor and E. R. Schumacher 6 May 1980 23 p refs (ZR0210203)
(AD-A087999; NOSC/TR-556) Avail: NTIS HC A02/MF A01 CSCL 20/6

An optical NOT gate has been demonstrated, exhibiting close to 100% modulation and requiring a minimum of 1.2 V for switching between states. An optical AND gate has been demonstrated, using two interferometric intensity modulators in series. A device functioning as either an optical EXCLUSIVE OR gate or an even parity generator has been demonstrated, also exhibiting nearly 100% modulation. Lithium niobate cleaving and polishing techniques were examined, indicating further research is required in this area. GRA

N80-33216# University of Southern California, Los Angeles. Dept. of Materials Science.
OPTICAL AND MECHANICAL PROPERTIES OF INFRARED MATERIALS Final Report
Stephen M. Copley Jul. 1980 66 p refs
(Contract F49620-78-C-0065; AF Proj. 2306)
(AD-A088120; AFOSR-80-0632TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

Optical and mechanical properties of various IR transmitting materials were investigated. Of special interest was the possibility of strengthening such materials through the formation of point defect complexes without increasing their IR absorption. A major facility for determining IR absorption was developed. The materials investigated include alkali halides, alkaline earth fluorides, Al-doped ZnSe and doped MgO. It was found that the hardness of ZnSe doped with Al and CaF2 doped with Gd could be increased through thermal treatment, however, the identity of the point defect complex producing this hardening could not be determined. GRA

N80-33217# European Office of Aerospace Research and Development, FPO New York 09510.
EUROPEAN FIBER OPTICS. USAF LABORATORY EXPERTS VISIT
E. Mason Friar, Armen E. Mardiguian, Randall L. Ray, Edward W. Taylor, and Andrew Yang Dec. 1979 14 p
(AD-A088209; EOARD-TR-80-11) Avail: NTIS HC A02/MF A01 CSCL 20/6

A team of USAF laboratory experts conducted an assessment of European expertise in fiber optics research, development, and products. Organizations in England, France, Germany and the Netherlands were visited. The team's conclusion is that, while the US holds the advantage in many areas (especially in the development of new components), Europe leads in system implementation and has several unique components and processes of value to the US fiber optics effort. A brief review of each visit is included. GRA

N80-33218# OptiMetrics, Inc., Ann Arbor, Mich.
REDUCTION AND ASSESSMENT OF INFRARED BACKGROUND DATA Interim Report
Scott M. Singer, Frederick G. Smith, Timothy J. Rogne, and Richard A. Steinberg 7 Aug. 1980 76 p refs
(Contract N00173-79-C-0461; ZF32391003)
(AD-A088241; OMI-80-002; NRL-MR-4284; NRL/EOTPO-62) Avail: NTIS HC A05/MF A01 CSCL 17/5

The outstanding problem in designing passive infrared detection sensors is the design of effective target/background discrimination algorithms. A key factor in the design process is the requirement for a data base of high spatial resolution, low noise, background imagery. The cloud and ocean sunglitter data discussed in this report, obtained by Cincinnati Electronics Co. (CECO), are intended to help satisfy this requirement for infrared (IR) background imagery. We recommend that future IR backgrounds measurements with the CECO radiometer incorporate the following suggestions: the CECO radiometer should be upgraded to incorporate dc restoration; data should be recorded from all 24 detector channels, rather than just 8 channels; tape recorder noise should be decreased by improving the data recording system. GRA

N80-33219# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN AND IMPLEMENTATION OF A FIBER-OPTIC GAMMA-MEASUREMENT SYSTEM
R. P. Reedy and D. W. Crawford 19 May 1980 10 p refs Presented at Intern. Symp. Soc. of Photo-Opt. Instr. Engr., San Diego, Calif. 28 Jul. - 1 Aug. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84109) Avail: NTIS HC A02/MF A01

The downhole portion of a measuring system for gamma rays is described. Three alternative designs are presented for radiation-resistant collimating and condensing lenses, sample cells, turning mirrors, and fiber-optic termination techniques. Mechanical mounts and positioners, shielding, alignment, test methods, and field installation are also discussed. Some general design suggestions for optical systems in adverse environments are included. DOE

N80-33220# Sandia Labs., Albuquerque, N. Mex. Digital Systems Development Div.
FIBER OPTIC COMMUNICATION LINKS
R. H. Meyer 1980 20 p Presented at the IMOG Meeting on Subgroup Environ. Testing, Albuquerque, N. M., 20 May 1980
(Contract EY-76-C-04-0789)
(SAND-80-1290C; CONF-800574-1) Avail: NTIS HC A02/MF A01

Fiber optics is a new, emerging technology which offers relief from many of the problems which limited past communications links. Its inherent noise immunity and high bandwidth open the door for new designs with greater capabilities. Being a new technology, certain problems can be encountered in specifying and installing a fiber optic link. A general fiber optic system is discussed with emphasis on the advantages and disadvantages. Finally, a general purpose prototype Sandia communications link is presented. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-33221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL THERMIONIC ENERGY CONVERSION WITH ESTABLISHED ELECTRODES FOR HIGH-TEMPERATURE TOPPING AND PROCESS HEATING Final Report
James F. Morris Jul. 1980 33 p refs
(Contract EC-77-A-31-1062)
(NASA-TM-81555; DOE/NASA/1062-6; E-514) Avail: NTIS HC A03/MF A01 CSCL 20I

Applied research-and-technology (ART) work reveals that optimal thermionic energy conversion (TEC) with approximately 1000 K to approximately 1100 K collectors is possible using well established tungsten electrodes. Such TEC with 1800 K emitters could approach 26.6% efficiency at 27.4 W/sq cm with approximately 1000 K collectors and 21.7% at 22.6 W/sq cm with approximately 1100 K collectors. These performances require 1.5 and 1.7 eV collector work functions (not the 1 eV ultimate) with nearly negligible interelectrode losses. Such collectors correspond to tungsten electrode systems in approximately 0.9 to approximately 6 torr cesium pressures with 1600 K to 1900 K emitters. Because higher heat-rejection temperatures for TEC allow greater collector work functions, interelectrode loss reduction becomes an increasingly important target for applications aimed at elevated temperatures. Studies of intragap modifications and new electrodes that will allow better electron emission and collection with lower cesium pressures are among the TEC-ART approaches to reduced interelectrode losses. These solutions will provide very effective TEC to serve directly in coal-combustion

products for high-temperature topping and process heating. In turn this will help to use coal and to use it well. A.R.H.

N80-33222# Maryland Univ., College Park. Dept. of Physics and Astronomy.
PARAMETRIC INSTABILITIES OF ELECTRON CYCLOTRON WAVES IN PLASMAS
V. K. Tripathi and C. S. Liu Mar. 1980 21 p refs
(Contracts N00014-77-C-0590; DE-AS05-77DP-40032)
(AD-A087742; PUB-80-160; TR-80-091) Avail: NTIS HC A02/MF A01 CSCL 20/9

We have studied the parametric instabilities of electron cyclotron waves in the Elmo Bumpy Torus (EBT) ring and the large tokamaks eg. PLT. In the EBT, the electron cyclotron pump of finite wavenumber k sub o decays into two Bernstein modes at the second harmonic cyclotron layer and can account for the heating of the ring in the initial phase. The coupling coefficient for this decay vanishes for a dipole pump, whereas the convective threshold with finite k sub o is about 200 W/sq cm. For large Tokamaks, the convective threshold for various decay channels turns out to be about or - 200 KW/sq cm at 3mm wavelength. GRA

N80-33223# Naval Research Lab., Washington, D. C.
XUV ALUMINUM SPECTRA OF LASER-PRODUCED PLASMAS Interim Report
G. A. Doschek and U. Feldman 15 Jul. 1980 15 p refs
(RR011094I)
(AD-A088107; NRL-8416) Avail: NTIS HC A02/MF A01 CSCL 07/4

XUV aluminum spectra from 200 to 500 A of laser-produced plasmas are discussed. The plasmas were obtained by focusing Nd:glass and CO2 laser pulses onto planar targets. The spectrograph was a normal incidence instrument without an entrance slit. Therefore monochromatic images of the plasma are formed at the focal plane, rather than spectral lines. Kodak 101 film was used to record the spectra. Images of the plasmas due to transitions in Al V through Al X were identified using a theoretical synthetic aluminum spectrum. The time and space integrated relative numbers of the ions form Al V through Al X can be obtained from a comparison of the synthetic and laser-plasma spectra. The comparison enables determination of the film calibration curve and the efficiency of the instrument with wavelength. The morphology of the expansion of the plasma is also discussed. The plasma of the highest temperature ions (Al XI) expands outward in cylindrically shaped structures. The expansion of the lower temperature plasma (such as Al VII) is also cylindrical in appearance, but the images are not as tightly confined to the target normal as for the hotter ions. GRA

N80-33224# California Univ., Berkeley. Electronics Research Lab.
PLASMA THEORY AND SIMULATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
C. K. Birdsall 31 Dec. 1979 102 p refs
(Contracts N00014-77-C-0578; DE-AS03-76EF-00034; DE-AT03-76ET-53064; W-7405-eng-48)
(AD-A088331; QPR-4) Avail: NTIS HC A06/MF A01 CSCL 20/9

In the last QPR, it was shown that our simulation exhibited strong ion trapping at saturation in the lower-drift-velocity regime with vE less than vti as our model had assumed a constant density and vE drift. The typical total ion momentum (Fig. 1a) and ion kinetic energy (Fig. 1b) are exponentially growing in time in the linear regime. In Fig. 1a, the net ion momentum increases in the negative x direction which is the wave propagation direction. Recall that ions in our model are initially in an electrostatic, steady equilibrium state with the ion diamagnetic drift velocity cancelled by the E x B drift velocity. GRA

N80-33225# Naval Research Lab., Washington, D. C.
A DIVERTED PLASMA REVERSED FIELD PINCH
Wallace M. Manheimer 16 Jul. 1980 11 p refs
(Contract EX-76-A-34-1006)
(AD-A088049; NRL-MR-4258) Avail: NTIS HC A02/MF A01 CSCL 20/9

This memo proposes a poloidal divertor as a method of reducing the strong plasma-wall interaction inherent in a reversed field pinch. GRA

N80-33226# Naval Research Lab., Washington, D. C.
ELECTRON CYCLOTRON/UPPER HYBRID RESONANT PREIONIZATION IN THE ISX-B TOKAMAK Interim Report
R. M. Gilgenbach (JAYCOR, Alexandria, Va.), R. F. Lucey (JAYCOR, Alexandria, Va.), K. E. Hackett (MIT, Cambridge), K. E. Burrell (General Atomic Corp., La Jolla, Calif.), M. Hacker (General Atomic Corp., La Jolla, Calif.), M. E. Read, V. L. Granatstein, A. C. England (ORNL, Tenn.), C. M. Loring (ORNL, Tenn.), J. B. Wilgen (ORNL, Tenn.) et al 20 Jun. 1980 34 p refs
(Contracts EX-77-A-34-1015; W-7405-eng-26; ET-78-S-02-4714)
(AD-A088086; NRL-MR-4248) Avail: NTIS HC A03/MF A01 CSCL 18/1

Preionization experiments have been performed on a Tokamak by injecting about 80 kW of microwave power at 35 GHz for up to 15 ms. Microwave absorption occurs at the electron cyclotron and upper hybrid resonance frequencies as predicted by theory. Preionization causes substantial (40%) reductions in loop voltage during the initial phase of the Tokamak shot. Flux (volt second) savings with preionization are about 30% in the first 2 ms or about 2% of the total flux expenditure in a Tokamak shot. The plasma current starts 20 microsec earlier and rises 1.4 times more rapidly in the preionized case. Electron densities of 5 x 10 to the 12th power/cu cm can be sustained with only a toroidal magnetic field during microwave injection. The bulk electron temperature in the preionized plasma is about 10 eV although there are indications of higher electron temperatures (50 eV) in the upper hybrid resonance layer. During the early stages of ohmic heating the preionization is effective in decreasing the peak of the radiated power. GRA

N80-33227# Naval Research Lab., Washington, D. C.
HEATING AT THE ELECTRON CYCLOTRON FREQUENCY IN THE ISX-B TOKAMAK Interim Report
R. M. Gilgenbach (JAYCOR, Alexandria, Va.), M. E. Read, K. E. Hackett (MIT, Cambridge), R. F. Lucey (JAYCOR, Alexandria, Va.), B. Hui, V. L. Granatstein, K. R. Chu, A. C. England (ORNL, Tenn.), C. M. Loring (ORNL, Tenn.), O. C. Eldridge (Tennessee Univ., Knoxville) et al 14 Aug. 1980 17 p refs
(Contracts EX-77-A-34-1015; W-7405-eng-26; ET-78-S-02-4714)
(AD-A088087; NRL-MR-4308) Avail: NTIS HC A02/MF A01 CSCL 18/1

We report results of electron cyclotron heating (ECH) experiments in which 80 kW of microwave power from a 35 GHz gyrotron is injected into a Tokamak with large single pass absorption. For 10 ms microwave pulses, incident from the high field side of the torus, the central electron temperature increases from 850 eV to 1250 eV, in agreement with empirical transport code calculations. For the first time in a Tokamak, we demonstrate that electron temperature scales linearly with ECH power. GRA

N80-33228# Nebraska Univ. - Lincoln. Dept. of Mechanical Engineering.
PSEUDO-SHOCK AS A QUALITATIVE MODEL IN THE INVESTIGATION OF THE INFLUENCE OF WALL ROUGHNESS ON THE PERFORMANCE OF SUPERSONIC MHD GENERATORS Final Report
Pau-Chang Lu Jul. 1980 94 p refs
(Grant AF-AFOSR-0083-79; AF Proj. 2308)
(AD-A088333; UNLMEPCL-80-1; AFOSR-80-0599TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

A preliminary study, based on an extension of Crocco's pseudo-shock model, has been carried out to explain and predict qualitatively the rather gradual pressure rise in a supersonic MHD generator, to account for the influence of wall roughness on the core flow. A system of non-linear ordinary differential equations is formulated for the wall layer and core, with proper electromagnetic conditions enforced at the interface. Extensive numerical experiments are also presented, which demonstrate indeed the qualitative link between the theory of MHD pseudo-shock and the observed pressure ramp caused by rough walls. GRA

N80-33229# Naval Research Lab., Washington, D. C.
PLASMA DIAGNOSTICS USING PHOTON-INDUCED

CHARGE TRANSFER Interim Report
J. F. Seely and R. C. Elton Aug. 1980 44 p refs
(Contract EX-76-A-34-1010)
(AD-A088228; NRL-MR-4317) Avail: NTIS HC A03/MF A01 CSCL 20/9

A method is described whereby a partner in a binary charge transfer process is photon-excited to a state in which the process can proceed at a greatly enhanced rate. The excited state may be real ('resonance-enhancement') or virtual. With the former, radiative decay fluorescent emission indicates directly the initial state density. Similarly, excited product decay indicates the reaction rate. With known cross sections, this can yield the density of the other reactant under conditions localized in both space and time by the inducing laser pulse. Numerous examples directly applicable to fusion devices are indicated. GRA

N80-33230# Naval Research Lab., Washington, D. C.
TOKAMAK HEATING AND CURRENT MAINTENANCE WITH INTENSE PULSED ION BEAMS Interim Report
W. M. Manheimer and N. K. Winsor 21 Aug. 1980 63 p refs
(Contract EX-76-A-34-1006)
(AD-A088274; NRL-MR-4213) Avail: NTIS HC A04/MF A01 CSCL 18/1

This paper examines Tokamak heating with intense pulsed ion beams. It finds that plasma can be heated to ignition or to Q approximately 1 and depending on the injection scheme, the current can be maintained or even generated by the beam. GRA

N80-33231# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
NUMERICAL MODELLING OF AN END-PLUGGED THETA PINCH
R. D. Milroy and L. C. Steinhauer Apr. 1980 43 p refs Submitted for publication
(Contract DE-AC06-76ET-53027)
(MSNW-80-1146-2) Avail: NTIS HC A03/MF A01

Analytical and numerical studies of an end plugged theta pinch are described. The analytical mode treats the ablated plug plasma in the quasistatic limit where radiation losses balance energy flowing from the main plasma. This model is used to calculate the enhancement in energy confinement due to an ablating end plug for various plug species. The numerical model employs a one dimensional, time dependent magnetohydrodynamic code. Results of calculations simulating the Scylla 4-P end plugged theta pinch experiment are presented. The calculations achieved reasonable agreement with experiment except for certain notable discrepancies, believed to spring from two dimensional effects. DOE

N80-33232# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
KINETIC-THEORY DESCRIPTION OF ELECTRON HEAT TRANSFER IN A PLASMA
M. H. Shirazian and L. C. Steinhauer Apr. 1980 45 p refs
(Contracts DE-AC06-76ET-53027; EY-76-C-06-2319)
(MSNW-801146-1) Avail: NTIS HC A03/MF A01

Electron heat flux in a fully ionized gas between two parallel boundaries, separated by a distance L, is studied. Two full range moment methods with the assumption of a two sided distribution function are employed to analyze the relation between the electron heat flux and the plasma collisionality parameter L/lambda/sub ei/, both with and without electron-ellectron collisions (lambda/sub ei/, is the electron-ion collision mean free path). The electron heat flux compared to free convective flux and the continuum heat flux is determined as a function of L/lambda/sub ei/, over the entire range from free flow to continuum regimes. DOE

N80-33233# Los Alamos Scientific Lab., N. Mex.
TOKAMAK POLOIDAL FIELD SYSTEMS Progress Report, 1 Jan. - 31 Dec. 1979
John D. Rogers May 1980 15 p refs
(Contract W-7405-eng-36)
(LA-8375-PR) Avail: NTIS HC A02/MF A01

The development of superconducting Tokamak poloidal field systems is addressed. Progress is discussed on the design of a 20 MJ, 50 kA, 7.5 T superconducting pulsed energy storage coil operated in a 1 to 2 s bipolar mode from +7.5 T to -7.5 T in 1982. Conductor development for the coil is presented. A facility that uses a traction motor energy transfer system to test coils in the 20 to 100 MJ energy range is discussed. Current interrupter development and testing for protection and energy transfer circuits are also presented. DOE

N80-33234# California Univ., Livermore. Lawrence Livermore Lab.
STUDIES IN TANDEM MIRROR THEORY
D. E. Baldwin, R. H. Cohen, T. A. Cutler, T. B. Kaiser, B. G. Logan, Y. Matsuda, A. A. Mirin, L. D. Pearlstein, M. Porkolab, M. E. Rensink et al 2 Jun. 1980 16 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980; sponsored by International Atomic Energy Agency Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83519-Rev-1; CONF-800707-2-Rev-1; IAEA-CN-38/F-4) Avail: NTIS HC A02/MF A01

The formation, maintenance, and microstability of thermal barriers which were introduced as a means for improving tandem mirror reactor performance at reduced technological demands are discussed. Calculations of tandem mirror central cell beta limits due to MHD ballooning modes are also described. DOE

N80-33235# California Univ., Livermore. Lawrence Livermore Lab.
THEORY OF FIELD-REVERSED MIRRORS AND FIELD-REVERSED PLASMA-GUN EXPERIMENTS
D. V. Anderson, S. P. Auerbach, H. L. Berk, J. K. Boyd, T. A. Brengle, J. A. Byers, B. I. Cohen, W. C. Condit, J. C. Eddleman, R. P. Freis et al 22 May 1980 18 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab., Illinois Univ., Urbana, and New York Univ., N. Y. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83518; CONF-800707-6; IAEA-CN-38/R-2) Avail: NTIS HC A02/MF A01

Experimental and theoretical studies of field reversal in a mirror machine are reported. Plasma gun experiments demonstrate that reversed field plasma layers are formed. Low energy plasma flowing behind the initially produced plasma front prevents tearing of the layer from the gun muzzle. MHD simulation shows that tearing can be obtained by impeding the slow plasma flow with a plasma divider. It is demonstrated theoretically that a field reversed mirror imbedded in a multipole field can be sustained in steady state with neutral beam injection even in the absence of impurities. MHD stability analysis shows that growth rates of elongated reversed field theta pinch configurations decrease with axial extension, which indicates the importance of including finite Larmor radius in the analysis. Tilting mode criteria are dramatically improved by proper shaping, and a problimak shape is proposed. Tearing mode stability of reversed field theta pinches is greatly enhanced by flux exclusion. Self-consistent, 1-1/2 dimensional transport codes were developed, and initial results are presented. DOE

N80-33236# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR ION-CYCLOTRON WAVES IN MIRROR MACHINES
B. I. Cohen, G. R. Smith, H. L. Berk, J. A. Byers, J. F. Clauser, D. L. Correll, A. H. Futch, R. K. Goodman, D. P. Grubb, and L. L. LoDestro 22 May 1980 13 p refs Presented at 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980; sponsored by International Atomic Energy Agency Prepared in cooperation with Rochester Univ., N.Y. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83517; CONF-800707-4; IAEA-CN-38/S-1) Avail: NTIS HC A02/MF A01

Experimental results on ion cyclotron waves observed in the 2XIIB mirror machine are reviewed, and relevant theoretical work is discussed. The work reported generally substantiates the quasilinear diffusion model of mirror plasma confinement, but also suggests alternatives. The end loss current required by theory of the drift-cyclotron loss-cone (DCLD) instability agrees with

measurements of this current. The experiment indicates that an increased ratio of plasma radius to ion gyroradius improves plasma confinement. However, measurements sometimes show a second ion-cyclotron mode, which is not the DCLC mode. Theoretical work on loss-cone instabilities has concentrated on linear, quasilinear, and fully nonlinear models of increased sophistication and experimental applicability. DOE

N80-33237# California Univ., Livermore. Lawrence Livermore Lab.

TANDEM MIRROR FUSION-FISSION HYBRID STUDIES

J. D. Lee 24 Apr. 1980 27 p refs Presented at the 2d Intern. Conf. on Emerging Nucl. Energy Systems, Lausanne, Switzerland, 4-8 Apr. 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-84018; CONF-800446-2-Rev-1) Avail: NTIS HC A03/MF A01

The concept of combining nuclear fusion and nuclear fission techniques is discussed. Initial tandem mirror hybrid studies predict the ability to produce large amounts of fissile fuel (2 to 7 tons U233 per year from a 4000 MW plant) at a cost that adds less than 25% to the cost of power from a light water reactor. L.F.M.

N80-33238# California Univ., Livermore. Lawrence Livermore Lab.

OPTICAL COATINGS FOR LASER FUSION APPLICATIONS

W. H. Lowdermilk, D. Milam, and F. Rainer 24 Apr. 1980 28 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-83582; CONF-800439-7) Avail: NTIS HC A03/MF A01

Lasers for fusion experiments use thin-film dielectric coatings for reflecting antireflecting and polarizing surface elements. Coatings are most important to the Nd:glass laser application. The most important requirements of these coatings are accuracy of the average value of reflectance and transmission, uniformity of amplitude and phase front of the reflected or transmitted light, and laser damage threshold. Damage resistance strongly affects the laser's design and performance. The success of advanced lasers for future experiments and for reactor applications requires significant developments in damage resistant coatings for ultraviolet laser radiation. DOE

N80-33239# Oak Ridge National Lab., Tenn.

LARGE ASPECT RATIO TOKAMAK STUDY

R. L. Reid, J. A. Holmes, W. A. Houlberg, Y. K. M. Peng, D. J. Strickler, T. G. Brown (Grumman Aerospace Corp.), and G. W. Wiseman (Grumman Aerospace Corp.) Jun. 1980 57 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7278) Avail: NTIS HC A04/MF A01

The potential for producing a viable longburn Tokamak reactor by enhancing the volt second capability of the ohmic heating transformer through the use of high aspect ratio designs was investigated. The plasma physics, engineering, and economic implications of high aspect ratio Tokamaks were assessed in the context of extended burn operation. Using a one dimensional transport code, plasma startup and burn parameters were addressed. The pulsed electrical power requirements for the poloidal field system, which have a major impact on reactor economics, were minimized by optimizing the startup and shutdown portions of the Tokamak cycle. A representative large aspect ratio Tokamak with an aspect ratio of 8 was found to achieve a burn time of 3.5 h at capital cost only approximately 25% greater than that of a moderate aspect ratio design Tokamak. DOE

N80-33240# Ad-Ex International, Portola Valley, Calif.

ELECTROMAGNETIC INSTABILITIES IN COLLISIONLESS PLASMAS

G. Laval, R. Pellat, and M. Vuillemin May 1980 38 p refs Transl. into ENGLISH from French report CN-21/71 p 259-276 Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab.

(UCRL-Trans-11593; CN-21/71) Avail: NTIS HC A03/MF A01

The stability of inhomogeneous collisionless plasmas with respect to electromagnetic perturbations is studied. The macroscopic equilibrium parameters depend on a single coordinate of an orthogonal system. The current carried by the particles of the plasma is directed along another coordinate axis. The perturbations considered are constant along the current lines. In plane geometry, for example, the distribution functions of the particles depend only on the energy and on the moment along OZ of the Hamiltonian of a particle. The equilibrium is inhomogeneous along OX and the perturbations are invariant with respect to OZ. A Lyapunov function is constructed. DOE

N80-33241# California Univ., Livermore. Lawrence Livermore Lab.

PLASMA CONFINEMENT EXPERIMENTS IN THE TMX TANDEM MIRROR

T. C. Simonen, C. A. Anderson, T. A. Casper, J. F. Clauser, F. H. Coensgen, W. C. Condit, D. L. Correll, W. F. Cummins, J. C. Davis, and R. P. Drake 22 May 1980 12 p refs Presented at the 8th Intern. Conf. of Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980

(Contract W-7405-eng-48)

(UCRL-83515; CONF-800707-5) Avail: NTIS HC A02/MF A01

Results from the tandem mirror experiment (TMX) are described. Tandem mirror density and potential profiles are produced using end plug neutral beam injection and central cell gas fueling. TMX parameters are near those predicted theoretically. The end plug electron temperature is higher than in the comparably sized single mirror 2XIIB. Axial confinement of the finite beta central cell plasma is improved by the end plugs by as much as a factor of 9. In TMX, end plug microinstability limits central cell confinement in agreement with theory. DOE

N80-33242# Argonne National Lab., Ill. Fusion Power Program.

FUSION REACTOR BLANKET/SHIELD DESIGN STUDY

D. L. Smith, R. G. Clemmer, S. D. Harkness, J. Jung, J. L. Krazinski, R. F. Mattas, H. C. Stevens, C. K. Youngdahl, C. Trachsel (McDonnell Douglas Astronautics Co., St. Louis), and D. Bowers (McDonnell Douglas Astronautics Co., St. Louis) Jul. 1979 426 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co., St. Louis

(Contract W-31-109-eng-38)

(ANL/FPP-79-1) Avail: NTIS HC A19/MF A01

A joint study of Tokamak reactor first wall/blanket/shield technology was conducted to identify key technological limitations for various tritium breeding blanket design concepts, establishment of a basis for assessment and comparison of the design features of each concept, and development of optimized blanket designs. The approach used involved a review of previously proposed blanket designs, analysis of critical technological problems and design features associated with each of the blanket concepts, and a detailed evaluation of the most tractable design concepts. Tritium breeding blanket concepts were evaluated according to the proposed coolant. The effort concentrated on evaluation of lithium and water cooled blanket designs and helium and molten salt cooled designs. Generalized nuclear analysis of the tritium breeding performance, an analysis of tritium breeding requirements, and a first wall stress analysis were conducted as part of the study. The impact of coolant selection on the mechanical design of a Tokamak reactor was evaluated. Reference blanket designs utilizing the four candidate coolants are presented. DOE

N80-33243# Pennsylvania State Univ., University Park.

STUDY OF FLOW AND LOSS PROCESSES AT THE ENDS OF A LINEAR THETA PINCH Progress Report, 1 Jun. 1979 - 30 Sep. 1980

Thomas M. York and Edward H. Klevans May 1980 68 p refs

(Contracts DE-AS02-78ET-53018; EY-76-S-02-4020)

(COO-4020-10) Avail: NTIS HC A04/MF A01

Experimental and analytical studies of particle and energy loss at the ends of a linear theta pinch was carried out. A study of transients occurring in the formation of reversed trapped fields within the coil, and of transients in the end region of a 25 cm long device was completed. A 1-D code proved to be highly accurate in describing loss events and defining transport

mechanisms in different experiments and is described here. A study of loss along field lines in a 50 cm long device generated new information on loss velocity, axial and radial temperature gradients, and established an initial effort in understanding thermal loss to the walls. Rotation and parallel trapped fields were added to the existing 0-D code. A new technique crowbar switch and magnetic field prediction code was developed. Direct measurement of electron velocity with Thomson scattering was accomplished experimentally. DOE

N80-33244# California Univ., Livermore. Lawrence Livermore Lab.
TANDEM MIRROR REACTORS WITH THERMAL BARRIERS
B. G. Logan, B. Arfin (NRL, Washington, D. C.), W. L. Barr, B. M. Boghosian, G. A. Carlson, T. C. Chu, J. L. Erickson, J. H. Fink (BNL, N.Y.), T. K. Fowler, and G. W. Hamilton 23 May 1980 15 p refs Presented at the 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with Wisconsin Univ., Madison
(Contracts W-7405-eng-48; ET-79-S-02-4636)
(UCRL-83505; CONF-800707-3; IAEA-CN-38/E-2) Avail. NTIS HC A02/MF A01

Preliminary calculations of Q and magnet designs are presented for three different versions of tandem mirror reactors (TMR) using thermal barriers to enhance plug potentials by auxiliary electron heating. These three versions called A-cell-barrier TMR, axisymmetric-barrier TMR, and inside-barrier TMR, exhibited reduced plug density and less required magnetic mirror field compared to TMR designs without thermal barriers. DOE

N80-33245# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROSTATIC LEVITATION AND TRANSPORT OF LASER FUSION TARGETS
Wayne L. Johnson and Charles D. Hendricks 22 May 1980 10 p refs Presented at IEEE/IAS 1980 Annual Meeting, Cincinnati, 28 Sep. - 2 Oct. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83981; CONF-800914-2) Avail: NTIS HC A02/MF A01

Several levitation concepts were evaluated resulting in the electrostatic quadrupole being chosen as the most universal. A levitator was constructed to handle laser fusion targets during quadrupole rail which was segmented to provide electrically controlled transport and confinement along the rail. This device demonstrated transport both vertical and horizontal of targets with appropriate mass to size ratios and remarkably stable confinement at atmospheric pressure. DOE

N80-33246# Science Applications, Inc., Ames, Iowa.
REVERSED-FIELD PINCH FUSION REACTOR
R. L. Hagenson and R. A. Krakowski (LASL, N. Mex.) 1980 14 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1494; CONF-800806-4) Avail: NTIS HC A02/MF A01

A conceptual engineering design of a fusion reactor based on plasma confinement in a toroidal reverse field pinch (RFP) configuration is described. The plasma was ohmically ignited by toroidal plasma currents which also inherently provided the confining magnetic fields in toroidal chamber. The 5-s dwell period between burn pulses for plasma quench and refueling allowed steady-state operation of all thermal systems outside the first wall; no auxiliary thermal capacity was required. A borated-water shield was located immediately outside the thermal blanket to protect the superconducting magnet coils. Both the superconducting poloidal and toroidal field were coils energized by homopolar motor/generators. Accounting for all major energy sinks yielded a cost-optimized system with a recirculating power fraction of 0.17; the power outputs is 750 MWe(net). DOE

N80-33247# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
SYSTEMS ASSESSMENT OF HEAVY ION BEAM FUSION DRIVERS Final Report, 1 Jan. 1978 - 31 Dec. 1979
T. Kammash, C. R. Drum, and R. D. Theisen May 1980 44 p refs
(Contract DE-AC08-79DP-40039)
(DOE/DP-40039) Avail: NTIS HC A03/MF A01

A systems analysis for a fusion reactor utilizing a heavy ion beam pellet fusion is carried out to evaluate the performance of several potential drivers. These include: hearthfire reference concepts 2 and 3; the RF linear accelerator; and the induction linac system. Accelerator systems utilizing rapid cycling synchrotrons are shown to be the least attractive drivers unless the efficiency of this component is sufficiently improved. Using a power cost formula that accounts for the accelerator operating cost it appears on the basis of available data that only one driver might fall within the economically acceptable range of producing electric power at 4 cents a kilowatt hour if certain optimistic conditions are met. DOE

N80-33248# Los Alamos Scientific Lab., N. Mex.
INITIAL REVERSED-FIELD PINCH EXPERIMENTS ON ZT-40 AND RECENT ADVANCES IN RFP THEORY
D. A. Baker, C. J. Buchenauer, L. C. Burkhardt, T. E. Cayton, E. J. Aramana, G. I. Chandler, R. S. Christian, R. Dagazian, J. M. DiMarco, and J. N. Downing 1980 14 p refs Presented at the IAEA 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1 Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1834; CONF-800707-11) Avail: NTIS HC A02/MF A01

The ZT-40 reversed field pinch was operated in several modes. An analytic ohmic heating and ignition model both confirm and provide guidance for transport codes. Nondissipative formation schemes were analyzed and ideal MHD stable evolution and burn scenarios were found. Particle and fluid simulations have produced qualitative agreement with respect to the nonlinear behavior of $m = 0$ resistive g modes. Helical ohmic reversed field states are produced by a 2D dynamical simulation, and nonlinear analytic work describes the final state. A fast resistive MHD code for linear stability has clarified the relations between several kinds of resistive instabilities. Ballooning modes and g modes in systems with arbitrary magnetic shear including resistivity and viscosity, were studied in a unified treatment with growth rate vs wavenumber showing the existence of important cutoffs. DOE

N80-33249# Los Alamos Scientific Lab., N. Mex.
COMPACT TORUS EXPERIMENTS AND THEORY
W. T. Armstrong, D. C. Barnes, R. R. Bartsch, R. J. Commisso, C. A. Ekdahl, I. Henins, D. W. Hewett, H. W. Hoida, T. R. Jarboe, and C. G. Lilliequist 1980 32 p refs Presented at the 8th Intern. Conf., on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-1826; CONF-800707-12) Avail: NTIS HC A03/MF A01

Two types of compact toroids have been studied: Spheromaks and field reversed configurations. Spheromaks, which contain both toroidal and poloidal fields, have been formed with a magnetized coaxial injector and trapped in both prolate and oblate flux conservers. As expected from theory, the prolate configuration always tilts, but the oblate configuration can be made stable even in the presence of a guide field. Theoretical studies of the FRC (no toroidal field) have been compared with the results of two field reversed theta-pinches, FRX-A and FRX-B. DOE

N80-33250# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Nuclear Engineering.
THEORY OF FIELD-REVERSED MIRRORS AND FIELD-REVERSED PLASMA-GUN EXPERIMENTS
D. V. Anderson, S. P. Auerbach, H. L. Berk, J. K. Boyd, T. A. Brengle, J. A. Byers, B. I. Cohen, W. C. Condit, J. C. Eddleman, and R. P. Freis 6 Jun. 1980 17 p refs Presented at the 8th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Brussels, 1-10 Jul. 1980 Prepared in cooperation with California Univ. Berkeley, Lawrence Berkeley Lab. and New York, Univ. Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83518-Rev-1; CONF-800707-6-Rev-1; Paper-IAEA-CN-38/R-2) Avail: NTIS HC A02/MF A01

Experimental and theoretical studies of field reversal in a mirror machine are reported. Plasma-gun experiments demonstrate that reversed field plasma layers are formed. Low energy plasma flowing behind the initially produced plasma front prevents tearing of the layer from the gun muzzle. MHD simulation shows that tearing can be obtained impeding the slow plasma flow with a plasma divider. It is demonstrated theoretically that a field reversed mirror imbedded in a multipole field can be sustained in steady state with neutral-beam injection even in the absence of impurities. MHD stability analysis shows that growth rates of elongated reversed field theta pinch configurations decrease with axial extension, which indicates the importance of including finite Larmor radius in the analysis. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also 33 *Electronics and Electrical Engineering* and 36 *Lasers and Masers*.

N80-33251# *Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.*

ESTIMATION RATE CONSTANTS FOR DIFFUSION-CONTROLLED INTERMACROMOLECULAR REACTIONS AT INFINITE DILUTION

Kazuyuki Horie and Itaru Mita Jun. 1980 13 p refs

(ISAS-580-Vol-45-No-5; ISSN-0372-1418) Avail: NTIS HC A02/MF A01

The mechanism of diffusion-controlled macromolecular reaction and chain dynamics in polymer reactions is examined. Termination between growing polymer radicals in free-radical polymerization and energy transfer between photo-excited species attached to polymer chains are included. The estimation of k sub q at infinite dilution uses several methods based on thermodynamic and hydrodynamic interaction parameters between polymer and solvent. Molecular-weight and solvent-power dependencies of the resulting k sub q at infinite dilution are discussed. S.F.

N80-33252# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SELF-CONSISTENT APW-k-VECTOR, p VECTOR METHOD. 1: THEORY

I. C. daCunhaLima, A. Ferreira DaSilva, and N. J. Parada Jun. 1980 18 p refs Submitted for publication

(INPE-1763-RPE/152) Avail: NTIS HC A02/MF A01

A first principle method based on an augmented plane wave - k vector p vector band structure calculation is derived in order to obtain the self consistent eigen-energies, cristalline potential and electronic charge density. The simplicity and extensions of the method are discussed, including comparison with the results obtained by the use of Chadi and Cohen special points technique. Author

N80-33253# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A MIXED BONDING BAND STRUCTURE CALCULATION FOR GaS AND AlAs, USING THE APW-k VECTOR p VECTOR METHOD

A. Ferreira daSilva, I. C. daCunhaLima, and N. J. Parada Jun. 1980 22 p refs Submitted for publication

(INPE-1762-RPE/151) Avail: NTIS HC A02/MF A01

The band structure of GaAs in a mixed covalent and ionic bonding was obtained. The energy levels at the gamma point are also obtained for AlAs. The ionicity is introduced as a parameter into the crystalline potential. The dependence of the energy levels and the momentum matrix elements on the values of the ionicity was studied. The value of the ionicity which gave the direct gap Eg = 1.52 eV for GaAs (the accepted experimental value) was found to be 0.1, and for AlAs Eg = 2.50 eV was obtained for an ionicity of 0.2. Author

N80-33254# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE HUBBARD MODEL FOR THE DISORDERED SYSTEMS: IN APPLICATION TO THE SPECIFIC HEAT OF THE PHOSPHORUS-DOPED SILICON

A. Ferreira daSilva, R. Kishore, and I. C. daCunhaLima Aug. 1980 28 p refs Submitted for publication

(INPE-1862-RPE/212) Avail: NTIS HC A03/MF A01

A self consistent many body theory of the disordered systems, described by the Hubbard Hamiltonian with random transfer integral was developed. The random nature of the system was taken into account by the Matsubara-Toyozawa theory of impurities in semiconductors. By considering the hydrogen like impurity states, the electronic specific heat of the uncompensated phosphorus doped silicon was calculated and compared with the experimental results. It was found that it agreed well with the experiment in the entire semiconductor to the dilute metallic region. T.M.

N80-33255# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ELECTRON CORRELATIONS IN NARROW BANDS

Ram Kishore Jul. 1980 8 p refs Presented at the 32A SBPC Meeting

(INPE-1813-RPE/181) Avail: NTIS HC A02/MF A01

The standard basis operators formalism is used to study the problem of electron correlations in narrow bands. The exact Dyson equation in the matrix form for Green's function is obtained by exploiting the many body theory. The present formalism provides a natural extension of Roth's two poles approximation scheme. S.F.

N80-33256# *Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.*

A STUDY OF METAL-SEMICONDUCTOR CONTACTS ON INDIUM PHOSPHIDE Annual Report, 1 Feb. - 30 Sep. 1979

G. Y. Robinson Griffiss AFB, N.Y. RADC May 1980 55 p refs

(Contract F19628-79-C-0016; AF Proj. 2306)

(AD-A087666; RADC-TR-80-108) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report describes the research accomplished during the first eight months of a 20 month program of research on metal semiconductor contacts to indium phosphide (InP). The Schottky barrier energy Phi sub B and contact resistance are correlated to the metallurgical behavior of metal/InP contacts by using Auger electron spectroscopy. A carefully processed set of samples were used to show conclusively that Phi sub B is greater on p-type InP than on n-type InP. This is shown to be the opposite from the behavior of GaAs and Si Schottky diodes fabricated at the same time using the same process. Several metallic structures have been investigated for use as ohmic contacts to InP. A Ni/Au/Ge system is shown to provide low resistance contacts to n-type InP after heat treatment. For ohmic contact to p-type InP, two metal systems have been tested, but neither system has proven to be suitable for practical InP devices as of yet. Low resistance contacts are found with heat treated Au/Mg contacts; however, the contact surfaces are nonuniform. Pd was substituted for Au in the Au/Mg contact in order to reduce In-Au alloying. Preliminary results indicate that the contact resistance of the Pd/Mg contacts is high. This may result from MgO formation at the critical InP interface during contact fabrication. GRA

N80-33257# Lincoln Lab., Mass. Inst. of Tech., Lexington.

CRYSTALLINE SILICON ON INSULATORS BY GRAPHOEPITAXY

Michael W. Geis, Dale C. Flanders, Dimitir A. Antoniadis, and Henry I. Smith 1979 4 p refs

(Contract F19628-80-C-0002; ARPA Order 2006)

(AD-A085435; MS-5107A; ESD-TR-79-348) Avail: NTIS HC A02/MF A01 CSCL 20/12

Graphoepitaxy is a technique that uses artificial surface relief structures to induce crystallographic orientation in thin films. A simple model for graphoepitaxy is presented which predicts materials that can be deposited on smooth amorphous substrates to produce a crystalline texture can be uniformly oriented by appropriate surface relief structures. Graphoepitaxy was used to achieve uniformly oriented silicon films 0.5 micron m thick over surface relief gratings etched into amorphous fused silica substrates. The silicon was first deposited as an amorphous film

and then crystallized using a scanned Ar laser beam. The mean [100] directions in the silicon were parallel to the grating and perpendicular to the substrate plane. Films uniformly doped with phosphorous (2.4 x 10 to the 17th power atoms/cu cm) had an electron mobility at least 40% of the bulk value. GRA

N80-33258# Hughes Research Labs., Malibu, Calif.
SOLID-PHASE EPITAXIAL GROWTH Final Report, 1 May 1975 - 30 Jun. 1979
John Roth Apr. 1980 102 p refs
(Contract N00014-75-C-0957)
(AD-A084175) Avail: NTIS HC A06/MF A01 CSCL 07/4

The growth of Si single crystal films by solid phase epitaxy (SPE) is reported. Direct SPE and silicide-interlayer SPE, in which a transition metal film is deposited onto the substrate and reacted with it prior to the deposition of amorphous Si, are discussed. It is shown that previous work on silicide-interlayer SPE was dominated by contaminant effects and did not represent the intrinsic behavior of the process. However, conducting interlayer SPE in a noncontaminating, ultrahigh vacuum environment did not improve the quality of the films, but instead changed the growth morphology, with the result that even films grown under the most stringent vacuum conditions are unsuitable for most microelectronic applications. The direct SPE of Si deposited onto a clean substrate is shown to produce high-quality epitaxial films on Si < 100 >. MOS transistors fabricated in SPE layers grown at 550 C functioned identically to their bulk Si counterparts. Several sources of contaminant introduction in SPE are discussed, and their effects on the growth morphology and crystal quality are reported. M.G.

N80-33259# Colorado State Univ., Fort Collins.
SEMICLASSICAL BOLTZMANN TRANSPORT THEORY IN SEMICONDUCTORS
D. K. Ferry 1980 10 p refs Repr. from Phys. of Nonlinear Transport in Semiconductors, 1980 p 117-125
(Contract N00014-78-C-0124; NR Proj. 373-048; RR0210301)
(AD-A084161; CSU-TR-N-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

A review is presented of the current status of theoretical solutions of the Boltzmann transport equation in semiconductors. In particular, high field transport is emphasized. The capabilities of the displaced Maxwellian approach, numerical techniques, and the Monte Carlo method are examined. M.G.

N80-33260# Rensselaer Polytechnic Inst., Troy, N. Y. Electrical and Systems Engineering Dept.
NONDESTRUCTIVE EVALUATION OF Si WAFERS USING SAW
P. T. Das, M. K. Roy, R. T. Webster, and K. Varahramyan Sep. 1979 9 p refs
(Contracts N00014-75-C-0772; Grant AF-AFOSR-3426-77; NR Proj. 009-017)
(AD-A084665; MA-ONR-34) Avail: NTIS HC A02/MF A01 CSCL 20/12

The attenuation and transverse acoustoelectric voltage arise out of coupling of the electric field accompanying a surface acoustic wave propagating on a piezoelectric substrate and the carriers in an adjacent semiconductor. These phenomena are useful in the study of the electronic properties of semiconductor surfaces and this nondestructive technique to evaluate the effects of Si wafer processing methods. The contactless nature of this method makes it possible to recharacterize the same wafer after repeated processing steps without fear of contaminating furnaces and other processing equipment. The phenomena are analyzed theoretically and the results used to interpret the data obtained for the experimental measurement of important wafer properties. The conductivity, surface carrier type and time constants associated with the emission and capture of carriers in surface traps are determined for silicon. The results are compared with those obtained from four point probe and C-V measurements. GRA

N80-33261# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESS IN InP AND RELATED COMPOUNDS Quarterly Progress Report, 13 Dec. 1979 - 12 Mar. 1980
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Apr. 1980 12 p
(Contract N00019-79-C-0533)
(AD-A084260) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The current voltage characteristics of Schottky barriers on p-type InP are presented. A set of masks designed to fabricate guarded Schottky diodes for making ionization coefficient measurements is described. GRA

N80-33262# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
A STUDY OF SECONDARY ION TRIPLE BOND ANALOGUES Interim Technical Report
D. T. Hodul, W. C. Harris, and G. H. Morrison 20 Aug. 1980 18 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-80-C-0538; NR Proj. 051-736)
(AD-A088423; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

Diatomic molecular ions isoelectronic with CN have been generated in ion implanted semiconductor materials and analyzed using secondary ion mass spectrometry (SIMS). Negative (IVA-VA) ions containing the VA species from IVA implanted IIIA-VA semiconductors are found to be produced more readily than the IVA ions. The triple bond analogues studied were of the general type (IVA-VA)-, (IIIA-VIA)-, (VA-VIA)-, and (IVA-VIIA) +. Molecular ion formation mechanisms and the analytical consequences of the results of this study are discussed. GRA

N80-33263# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESSES IN INP AND RELATED COMPOUNDS Quarterly Program Report, 13 Mar. - 12 Jun. 1980
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Jul. 1980 10 p
(Contract N00019-79-C-0533)
(AD-A088446; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The current-voltage characteristics of Schottky barriers on p-type InP are presented. A set of masks designed to fabricate guarded Schottky diodes for making ionization coefficient measurements is described. GRA

N80-33264# Massachusetts Inst. of Tech., Cambridge.
RAPID SOLIDIFICATION PROCESSING: AN OUTLOOK Technical Report, Oct. 1978 - Jan. 1980
M. Cohen, B. H. Kear (United Technologies Research Center, East Hartford, Conn.), and R. Mehrabian (NBS, Washington, D.C.) 11 Aug. 1980 25 p refs Presented at the 2d Conf. on Rapid Solidification Processing Principles and Technol., Reston, Va., 23-26 Mar. 1980 Prepared in cooperation with United Technologies Research Center, East Hartford, Conn. Sponsored in part by NBS
(Contracts N00014-76-C-0171; N00014-78-C-0387; F33615-76-C-5136; DARPA Order 3751; NR Proj. 031-795)
(AD-A088473; TR-7) Avail: NTIS HC A02/MF A01 CSCL 13/8

The elements of rapid solidification processing (RSP) are highlighted from the standpoints of (a) the fundamentals involved, (b) the prospects for new structure/property relationships, and (c) the interplay between materials processing and the wider field of materials science and engineering. Prototype methods of rapid solidification and consolidation are briefly described. Particular attention is then given to various solidification modes and resulting morphologies as a function of cooling rate from the molten state. These modes span the range of planar, cellular, dendritic, and segregationless (microcrystalline), solidification, the latter being achieved by critical or hypercritical undercooling. The need for careful characterization of RSP microstructures is emphasized, and important scientific challenges for advancing the field of RSP are stressed. GRA

N80-33265# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
EVIDENCE FOR AN OXYGEN INTERMEDIATE IN THE

CATALYTIC REDUCTION OF NO BY CO ON RHODIUM SURFACES
L. H. Dubois, P. K. Hansma, and G. A. Somorjai 29 Jul. 1980 29 p refs Submitted for publication Sponsored in part by DOE Prepared in cooperation with California Univ., Santa Barbara
(Contract N00014-78-C-0011; NR Proj. 056-673)
(AD-A088045; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

Evidence for an oxygen intermediate in the reaction of NO and CO to form N2 and CO2 over rhodium surfaces is presented. High resolution electron energy loss spectroscopy (ELS) measurements indicate that both NO and CO molecules associatively adsorb on the Rh(331) single crystal surface at 300 K. Chemisorbed NO readily dissociates on this surface upon heating at 450 K. At 700 K high resolution ELS and Auger electron spectroscopy (AES) both indicate that only oxygen is present on the catalyst surface. N2 desorption below this temperature is easily detected by mass spectroscopy. The addition of CO to this surface oxygen at 700 K results in the formation of gaseous CO2 and the removal of the surface oxygen species. Similar results were obtained when O2 was substituted for NO as a control indicating that oxygen is indeed a surface intermediate under our experimental conditions. GRA

N80-33266# IRT Corp., San Diego, Calif.
CHEMICAL REACTIONS ON SOLID SURFACES USING MOLECULAR BEAM TECHNIQUES Final Report, 1 Jan. 1972 - 30 Sep. 1980
Robert L. Palmer 31 Jul. 1980 24 p refs
(Contracts N00014-72-C-0247; N00014-77-C-0255; NR Proj. 056-527)
(AD-A088447; IRT-8162-006) Avail: NTIS HC A02/MF A01 CSCL 20/7

Thermal energy molecular beams have been used to study chemical interactions with metal surfaces. Chemisorption of simple molecules such as H2, O2, CH4, C2Hx and CO was investigated on single and polycrystalline surfaces of Pt, Ni, Co, and Ag. Kinetic parameters and reaction mechanisms were determined for model catalytic reactions including CO and C2Hx oxidation and methanation from H2/CO mixtures. Chemical reactions of NOx with CO and D2 on Pt(111) and other surfaces have been surveyed and the kinetics of NO and O2 chemisorption have been measured. The theory of adsorption/desorption kinetics is reviewed and certain deficiencies identified. GRA

N80-33267# Brown Univ., Providence, R. I. Div. of Engineering.
ELECTRONIC STRUCTURE AND STABILITY OF METALLIC GLASSES Final Report, 14 May 1976 - 14 May 1980
Jan Tauc 1 Aug. 1980 12 p refs
(Grant DAAG29-76-G-0221)
(AD-A088292; ARO-13723.10-P) Avail: NTIS HC A02/MF A01 CSCL 11/2

The work was concentrated on deepening our understanding of the properties of electrons in metallic glasses and amorphous thin films and their role in determining the atomic arrangement in these materials. It includes a photoemission study of Nb-Ni glasses, an analysis of an electronic contribution to the free energy of a binary liquid that determines the atomic correlations, EXAFS studies of the structure of Pb-Ge quenched glasses and amorphous thin films, optical studies of amorphous Au-Si system, and a study of the magneto-optic effect in Fe80B20 metallic glass. GRA

N80-33268# Frequency Electronics, Inc., New Hyde Park, N.Y.
VIBRATION RESISTANT QUARTZ CRYSTAL RESONATORS Research and Development Technical Report, 27 Aug. 1979 - 27 Feb. 1980
B. Goldfrank and A. Warner Jul. 1980 36 p
(Contract DAAK20-79-C-0272; DA Proj. 1L1-62705-AH-94)
(AD-A088286; DELET-TR-79-0272-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objectives of this investigation are to provide doubly rotated quartz crystal resonators that exhibit fast warm-up and low 'g' sensitivity. Warm-up is to be on the order of 1 PP10 to the 9th power in three minutes. The 'g' sensitivity is to be 1 PP10 to the 10th power maximum in any axis. GRA

N80-33269# Massachusetts Inst. of Tech., Cambridge. Crystal Physics and Optical Electronics Lab.
CRYSTAL GROWTH BY SKULL MELTING Final Report, 1 May 1976 - 30 Apr. 1979
A. Linz, D. J. Epstein, and H. P. Jensen 24 Jul. 1980 10 p
(Contract DAAG29-76-C-0039)
(AD-A088013; ARO-14080.1-PX) Avail: NTIS HC A02/MF A01 CSCL 20/2

Skull Melting and top seeded solution growth of YVO4 were studied. A computerized optical spectroscopy system was designed and implemented. Laser pump laser gain measurements were made of Nd:YAG and CAMGAR. GRA

N80-33270# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
INITIAL STUDY OF BALLISTIC EFFECTS FOR THE OPERATION OF GaAs FET DEVICES Final Report, Mar. 1979 - Feb. 1980
L. F. Eastman Jul. 1980 19 p refs
(Contract N00014-79-C-0290; ARPA Order 3720; NR Proj. 243-028)
(AD-A088350) Avail: NTIS HC A02/MF A01 CSCL 20/12

Ballistic electron motion at high velocity in the (100) direction in GaAs at both 77 K and room temperature has been determined by current-voltage data on thin layers. Molecular beam epitaxial abrupt layers .4-.5 microns thick with N- ohmic contacts on both sides, have been tested, and ballistic motion occurs below .5V applied voltage. Layers with a donor density of 1 x 10 to the 15th power/cc, and layers with an acceptor density of 1 x 10 to the 15th power/cc both yield space charge limited current data to agree with the corresponding ballistic transport models developed. Average electron velocity values five times higher than that obtainable in a standard FET are now possible for both 77 K and room temperature in such ballistic electron motion. Although the standard FET geometry, even with short gates, is precluded by thick depletion layers into lightly doped layers, from both the exposed surface and the interface with the semi-insulating substrate, it has been concluded that a ballistic electron transistor with a geometry similar to that of the permeable base transistor is possible for very high speed, high frequency, low noise performance. GRA

N80-33271# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
PERCOLATION AND ELECTRICAL CONDUCTION IN SUPERCONDUCTING COMPOSITES Interim Report
Christopher John Lobb Aug. 1980 129 p refs
(Contracts N00014-77-C-0085; N00014-75-C-0648; Grants NSF DMR-77-24295; NSF DMR-79-04155; NSF DMR-79-09011)
(AD-A088196; TR-10) Avail: NTIS HC A07/MF A01 CSCL 20/3

We report the experimental properties of a number of random superconductor-normal metal composites. Theoretical interpretation is also presented, with emphasis on the effects of geometrical randomness. The electrical properties of in situ multifilamentary Cu-V3Ga wires are discussed, with emphasis on critical current and field properties which are relevant to applications. We found that these wires had upper critical fields as high as 22.4 T at 4.2 K with a transition temperature of 15.5 K. Their overall critical current density compared favorably with commercial wires. The results of electrical measurements on in situ Cu alloy-Nb composites are reported which elucidate the roles of percolation and the proximity effect in these materials. Our data show that the proximity effect is very important in clean, low superconducting concentration samples, with geometrical percolation being more important as the matrix becomes dirtier. In addition, we discuss models for the superconducting to normal transition in these materials which include the effects of randomness and thermal fluctuations. A two dimensional thin film system based on Cu-Pb is discussed and shown to be qualitatively similar to the three dimensional in situ composites. GRA

N80-33272# Hoffman (P. R.) Co., Carlisle, Pa.
AUTOMATED X-RAY ORIENTATION FOR QUARTZ CRYSTAL RESONATORS Interim Report, 1 Jul. - 31 Dec. 1979
Robert W. Birrell, Robert J. Valihura, John L. Chambers, Myron A. Pugh, and S. Thomas Workman Jul. 1980 50 p refs

Prepared in cooperation with Advanced Research and Applications Corp., Sunnyvale, Calif.
(Contract DAAK20-79-C-0254; DA Proj. 1L1-62705-AH-94) (AD-A088063; DELET-TR-79-0254-1; IR-1) Avail: NTIS HC A03/MF A01 CSCL 14/2

The major objective of this program is to develop an automated X-ray orientation system which is capable of measuring the angles of cut of doubly rotated cuts of quartz (SC cut) to seconds of arc on a production basis. Precise measurement of Laue spots is used in conjunction with laser crystal surface measurements to determine the angle of cut. The entire procedure is under control of a dedicated minicomputer. A second objective is to angle correct the measured crystals. Several techniques are being studied to replace the conventional laboratory type correction procedure. GRA

N80-33273# Hanford Engineering Development Lab., Richland, Wash.
COMPUTER CODE FOR THE ATOMISTIC SIMULATION OF LATTICE DEFECTS AND DYNAMICS
J. O. Schiffgens, N. J. Graves, and C. A. Oster (Battelle Pacific Northwest Labs., Richland, Wash.) Apr. 1980 182 p refs 3 Vol.
(Contract DE-AC14-76FF-02170)
(HEDL-TME-78-55-Vol-2) Avail: NTIS HC A09/MF A01

Version 4 of COMENT is documented and current code options are defined. An effort was made to structure COMENT to allow for additional options with a minimum of change in the existing version of the code. Although COMENT was specifically written in FORTRAN 'V and COMPASS (CDC assembly language) to take full advantage of CDC 6000/7000 series computer characteristics, it can with relatively little effort be adapted to other computer systems. DOE

N80-33274# Ames Lab., Iowa. Dept. of Physics.
A-15 SUPERCONDUCTING COMPOSITES IN THE 0.1 MICRON REGION
D. K. Finnemore and J. D. Verhoeven 1980 16 p refs Presented at the Intern. Cryogenic Mater. Conf., Madison, Wis., 21 Aug. 1980
(Contract W-7405-eng-82)
(IS-M-274; CONF-800816-1) Avail: NTIS HC A02/MF A01

Consumable electrode arc casting procedures were used to produce 10 kg billets Cu-Nb alloys. The resulting dendrite morphology and homogeneity is suitable for industrial scale production of Nb3Sn-Cu multifilamentary superconducting wire for magnets in the 8 to 14 Telsa range. If proper heat flow patterns can be maintained, the same techniques should be suitable for 100 kg billets. In the design of these composites for magnet wire, a Cu70Nb30 casting is a good choice of Nb content if high J/sub c/ and ease of fabrication are the major considerations. If unusual strain tolerance is the primary consideration, then a lower Nb and lower Sn content is preferred. DOE

N80-33275# Sandia Labs., Livermore, Calif. Applied Physics Div.
OBSERVATION OF AN OPTICAL STARK EFFECT ON VIBRATION AND ROTATIONAL TRANSITIONS
L. A. Rahn, R. L. Farrow, M. L. Koszykowski, and P. L. Mattern Jun. 1980 15 p refs Submitted for publication
(Contract DE-AC04-76DP-00789)
(SAND-80-8707) Avail: NTIS HC A02/MF A01

Vibrational and rotational Raman transitions were shown to be shifted to lower frequencies in the presence of a nonresonant high intensity optical field. Experimental results using CARS spectroscopy for hydrogen and nitrogen are presented. The magnitude of the observed shift is in agreement with a calculation which considered the coupling of the optical field to the internuclear separation via the molecular electronic polarizability. The magnitude of the shift is proportional to the optical field intensity. DOE

N80-33276# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
SEQUENTIAL PURIFICATION AND CRYSTAL GROWTH FOR THE PRODUCTION OF LOW COST SILICON SUBSTRATES Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1980
Ming Liaw and F. S. DAragona May 1980 36 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-77CH-00178)
(SERI-8119-3/2; QTPR-2) Avail: NTIS HC A03/MF A01

Direct methods for the purification of MG-Si were used. Sequential steps of purification were followed by crystal growth. The steps of sequential purification included: leaching of MG-Si charge, phase separation of non-soluble impurities from molten silicon, reactive gas treatment of molten silicon, liquid-liquid extracting (called slagging), and impurity redistribution using ingot pulling. All the purification steps were performed in a consecutive manner using a crystal puller. The study of the purification by reactive gas treatment, and slagging was completed. Selection of a reusable crucible was also made. DOE

N80-33277# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
LIGHT INDUCED ELECTRON TRANSFER REACTIONS OF METAL COMPLEXES
Norman Sutin and Carol Creutz 1980 22 p refs Presented at the 9th Intern. Union of Pure and Appl. Chem. Symp. on Photochem., Seafeld, Austria, 13-19 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28043; CONF-800734-1) Avail: NTIS HC A02/MF A01

Properties of the excited states of tris(2,2'-bipyridine) and tris(1,10-phenanthroline) complexes of chromium(3), iron(2), ruthenium(2), osmium(2), rhodium(3), and iridium(3) are described. The electron transfer reactions of the ground and excited states are discussed and interpreted in terms of the driving force for the reaction and the distortions of the excited states relative to the corresponding ground states. General considerations relevant to the conversion of light into chemical energy are presented and progress in the use of polypyridine complexes to effect the light decomposition of water into hydrogen and oxygen is reviewed. DOE

N80-33278# Brookhaven National Lab., Upton, N. Y. Metallurgy and Materials Science Div.
EFFECTS OF IRRADIATION AND MECHANICAL STRESS ON THE SUPERCONDUCTING PROPERTIES OF CANDIDATE MAGNET CONDUCTORS
C. L. Snead, Jr. and Thomas Luhman 1980 60 p refs
(Contract DE-AC02-76CH-00016)
(BNL-27976) Avail: NTIS HC A04/MF A01

Neutron and charged-particle irradiation effects in NbTi and the A15-compound superconductors were investigated. The utility of these conductors in radiation fields was explored by defining the magnitude of critical-property changes with the fluence of various irradiating particles. The physical mechanisms that couple the irradiation defects to the observed critical-property changes are discussed. Annealing/recovery data on irradiated materials are included where they pertain to the understanding of the physical mechanisms involved, and thereby to the desirability of magnet annealing in actual operating circumstances. DOE

N80-33279# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
HIGH ANGLE GRAIN BOUNDARIES AS SOURCES OR SINKS FOR POINT DEFECTS
R. W. Balluffi Sep. 1979 64 p refs Presented at the ASM Mater. Sci. Seminar, Milwaukee, 15-16 Sep. 1979
(Contract DE-AS02-78ER-05002)
(DOE/ER-05002/8; CONF-7909100-2) Avail: NTIS HC A04/MF A01

A secondary grain boundary dislocation climb model for high angle grain boundaries as sources/sinks for point defects is described in the light of recent advances in the knowledge of grain boundary structure. Experimental results are reviewed and are then compared with the expected behavior of the proposed model. Reasonably good consistency is found at the level of present understanding of the subject. However, several gaps in knowledge still exist, and these are identified and discussed briefly. DOE

N80-33280# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE Annual Technical Progress Report, 1 Jan. - 31 Dec. 1979
D. F. Stein, L. A. Heldt, and A. W. Funkenbusch 1980 20 p refs
(Contract DE-AS02-76ER-02186)
(DOE/ER-02186) Avail: NTIS HC A02/MF A01

The influence of grain boundary chemical composition on hydrogen embrittlement was investigated. Auger electron spectroscopy was employed to determine the grain boundary compositions of nickel-copper alloys containing various concentrations of phosphorus and subjected to various thermal treatments. Phosphorus segregates to grain boundaries during slow cooling, accompanied by reduced concentrations of grain boundary copper. Tensile tests were conducted in air and following cathodic charging with hydrogen. All samples tested in air exhibited a completely ductile fracture; ductility was insensitive to grain boundary composition. Fractures of hydrogen-charged samples were brittle and intergranular; elongation to fracture increased significantly with increasing concentration of grain boundary phosphorus. The influence of phorsphorus segregation on embrittlement by hydrogen or by mercury is analyzed in terms of additive and interactive mechanisms. DOE

N80-33281# Illinois Univ., Urbana. Materials Research Lab.
PANEL REPORT ON THEORY OF SURFACES
Jan. 1979 72 p refs Presented at Council on Mater. Sci. Panel on Surface Theory, Hyannis, Mass., 14-18 Aug. 1978
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1307) Avail: NTIS HC A04/MF A01

Problem areas focussing on atoms, electrons and alloys are described and the role of the theory is discussed. For each of the research areas, a brief description of developments, future goals, methodologies, and impacts of applications areas is given. DOE

N80-33282# Hanford Engineering Development Lab., Richland, Wash.
SIMULATION OF SHORT-TERM ANNEALING OF DISPLACEMENT CASCADES IN FCC METALS
H. L. Heinisch, D. G. Doran, and D. M. Schwartz (California State Univ., Northridge) 1980 17 p refs Presented at the 10th Intern. Symp. on Effects of Radiation on Mater., Savannah, Ga., 3 Jun. 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2147-FP; CONF-800609-9) Avail: NTIS HC A02/MF A01

Computer models were developed for the simulation of high energy displacement cascades. Defect production functions for use in correlation analysis of radiation effects in fusion reactor materials were generated. In particular, the stochastic cascade annealing simulation code (SCAS) was developed and used to model the short term annealing behavior of simulated cascades in FCC metals. The code is fast enough to make annealing of high energy cascades practical. Sets of cascades from 5 keV to 100 keV in copper were generated by the binary collision code MARLOWE. DOE

N80-33283# Emory Univ., Atlanta, Ga. Dept. of Physics.
FAR INFRARED STUDIES OF SUPERCONDUCTING V3Si, Nb3Ge, AND Nb Progress Report and Renewal Proposal
Sidney Perkowitz 1980 14 p refs
(Contract DE-AS05-79ER-10436)
(DOE/ER-10436/1) Avail: NTIS HC A02/MF A01

The progress on far infrared techniques in the range 10 to 200 cm (1 to 25 meV) to examine the high temperature superconductors V3Si, Nb3Ge, and Nb, and the high temperature granular superconductor NbN is reported. Fourier and laser spectrometers and the technique of laser thermal spectroscopy yield information about the electron-photon spectral function, the temperature dependence of superconducting properties, and other fundamental aspects of high temperature homogeneous and inhomogeneous superconductors. A detailed theoretical analysis to complement the experimental work is recommended. DOE

N80-33284# Illinois Univ., Urbana. Dept. of Physics
ELECTRON TUNNELING INTO SUPERCONDUCTING INDIUM AND LEAD FILMS CONTAINING THE MAGNETIC IMPURITY MANGANESE Ph.D. Thesis
Juine-Kai Tsang 1980 145 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1316) Avail: NTIS HC A07/MF A01

Tunneling measurements of quench-condensed In-Mn and Pb-Mn alloy films were made. The results were compared with Shiba's theory of superconductors containing magentic impurities. The localized excited impurity states predicted by Shiba's theory were observed in both alloys. In addition to s-wave scattering, it was necessary to include P- and D-wave scattering of the conduction electrons in the theory in order to explain the experimental data. Partial agreement between the theory and the experimental data was obtained using phase shifts from band calculation. The results on In-Mn also agree with thermal conductivity data. DOE

N80-33285*# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRAM BRIEFS Interim Report, Oct. - Dec. 1979
W. Murray Bullis, ed. Apr. 1980 17 p refs Sponsored in part by Draper (Charles Stark) Lab.
(NASA Order C-32818-D; Contracts EA-77-A-01-6010; N00030-78-C-0100; N00019-79-1P-99003; MIPR-FY-1175-80-N310S; EG-77-C-01-4042; N00014-79-P-0051; N66001-79-MP-00052; ARPA Order 2397; ARPA Order 3882)
(NASA-CR-163592; PB80-191521; NBSIR-80-2006) Avail: NTIS HC A02/MF A01 CSCL 20L

Measurement technology for semiconductor materials, process control, and devices is discussed. Activities include: modeling of diffusion processes; analysis of spreading resistance measurements, and studies of resonance ionization spectroscopy; resistivity-dopant density relationships in p-type silicon; infrared detector materials; photoresist sensitometry; power transistor switching characteristics; and gross leak testing and application of an electrical alignment test structure. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-33286# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ON THE ANALOGY BETWEEN MATHEMATICAL PROBLEMS OF NON-LINEAR FILTERING AND QUANTUM PHYSICS Interim Report
Sanjoy K. Mitter Jun. 1980 67 p refs Submitted for publication
(Grants AF-AFOSR-3321-77; AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A088077; LIDS-P-1006; AFOSR-80-0583TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The main thesis of this paper is that there are striking similarities between the mathematical problems of stochastic system theory, notably linear and nonlinear filtering theory, and mathematical developments underlying quantum mechanics and quantum field theory. Thus the mathematical developments of the past thirty years in functional analysis, lie groups and lie algebras, group representations, and probabilistic methods of quantum theory can serve as a guide and indicator to search for an appropriate theory of stochastic systems. In the current state of development of linear and nonlinear filtering theory, it is best to proceed by 'analogy' and with care, since 'unitarity' which plays such an important part in quantum mechanics and quantum field theory is not necessarily relevant to linear and nonlinear filtering theory. The partial differential equations that arise in quantum theory are generally wave equations, whereas the partial differential equations arising in filtering theory are stochastic parabolic equations. Nevertheless the possibility of

passing to a wave equation by appropriate analytic continuation from the parabolic equation, reminiscent of the current program in euclidean field theory, should not be overlooked. GRA

N80-33287# ARO, Inc., Arnold Air Force Station, Tenn.
HEAT TRANSFER AND STATIC STABILITY TESTS OF THE GENERAL PURPOSE HEAT SOURCE (GPHS) CONFIGURATIONS AT MACH 8.0 Final Report, 16 Nov. - 7 Dec. 1979
W. A. Crosby and E. C. Knox AEDC Jan. 1980 32 p refs
(AD-A088031; AEDC-TSR-80-V7) Avail: NTIS HC A03/MF A01 CSCL 18/14

Heat transfer and static stability tests were conducted in the VKF Tunnel B at Mach 8. Discrete point surface heat flux measurements were made on the reference (unmodified) GPSH configuration over a range of inclination angles from -50 to 140 deg at several model orientations. Six-component static force and moment measurements were made on the reference GPHS configuration and three design modifications. An angle-of-attack range of -5 to 95 deg was covered at angles of sideslip from -9 to 15 deg and aerodynamic roll angles from -45 to 45 deg. GRA

N80-33288# General Energy Associates, Cherry Hill, N.J.
RELEVANCE OF THE SECOND LAW OF THERMODYNAMICS TO ENERGY CONSERVATION
Jan. 1980 37 p refs
(Contract DE-AT01-79CS-40178)
(DOE/CS-40178/01-Vol-1) Avail: NTIS HC A03/MF A01

An analysis is presented of the potential relevance of the use of analytical tools based on the second law of thermodynamics to existing federal programs for energy conservation in the industrial, transportation, building, and utility sectors in the US. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-33289# Purdue Univ., Lafayette, Ind.
FUTURE DIRECTIONS FOR DECISION SUPPORT
Robert H. Bonczek, Clyde W. Holsapple, and Andrew B. Whinston Jun. 1980 36 p refs Prepared in cooperation with Illinois Univ., Urbana
(Contract DAAG29-79-C-0154)
(AD-A087355; ARO-16231.2-EL) Avail: NTIS HC A03/MF A01 CSCL 05/8

A formal, generic description of decision support systems is introduced. This description views a decision support system as having three principal components: a language system, a knowledge system and a problem processing system. Several systems are described which fit the generic DSS idea, but which are (for the most part) not the customary kinds of systems encountered in business applications. Nevertheless, the concepts and techniques employed in these systems can make important contributions to the emergence of more powerful business oriented decision support systems. GRA

N80-33290# Sandia Labs., Albuquerque, N. Mex.
REALISTIC APPROACH TO THE PLANNING OF HIGH-TECHNOLOGY, HIGH-RISK PROJECTS
Marvin J. Becktell May 1980 10 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-1483) Avail: NTIS HC A02/MF A01

Approaches to high-risk project planning are reviewed and assessed. It is recognized that the need for changes in philosophy and for a practical and realistic approach to the management plan used to support high technology, high-risk projects, calls for bold, honest planning, and unbiased, objective guidance.DOE

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-33291# RAND Corp., Santa Monica, Calif.
SECURITY AND PRIVACY IN THE 80'S
Willis H. Ware May 1980 13 p Presented at the Honeywell Natl. Computer Security and Privacy Symp., Phoenix, Ariz., 15 Apr. 1980
(RAND/P-6492) Avail: NTIS HC A02/MF A01

The issue of information ownership as related to computer programs is presented. The information usage question from the point of view of society overall and the possibility of architectures for distributed arrangements that provide additional safeguard mechanisms are discussed. It is proposed that analysis is needed in order to understand the dimensions of computer oriented crime. The pros and cons of Senate bill S-240 are outlined. E.D.K.

N80-33292# RAND Corp., Santa Monica, Calif.
DATA QUALITY INDICATORS AND THEIR USE IN DATA BASE SYSTEMS
Robert L. Patrick May 1980 12 p
(RAND/P-6491) Avail: NTIS HC A02/MF A01

Data quality indicator (DQI) removes one flaw in the computer based information systems that lies with their inability to explicitly deal with uncertainty. The DQI is held in a one byte field immediately adjacent to the value whose quality it describes. When the value is read or written or moved, the accompanying quality indicator is also moved so the pair of fields are never separated. When the value is processed, the processing program can optionally process the quality indicator or ignore it. Simple examples are included to describe the concept adequately. The use of quality indicators to date and how this concept can lead to the solution of a major data processing problem that lies in the foreseeable future, are discussed. R.K.G.

N80-33293# RAND Corp., Santa Monica, Calif.
MATCHING AND ABSTRACTION IN KNOWLEDGE SYSTEMS
Frederick Hayes-Roth Jan. 1980 39 p refs Presented at the Symp. on Artificial Intelligence in Inform. Sci., 1979 Ann. Meeting of the Am. Soc. for Inform. Sci., Minneapolis
(RAND/P-6440) Avail: NTIS HC A03/MF A01

Partial matching, a central theoretical problem common to the fields of artificial intelligence and information science, was studied. Problems in computer programming are presented. Data representation is described. T.M.

N80-33294# Computer Corp. of America, Cambridge, Mass.
FUNDAMENTAL ALGORITHMS FOR CONCURRENCY CONTROL IN DISTRIBUTED DATA BASE SYSTEMS Final Technical Report, Jul. 1979 - Jan. 1980
Philip A. Bernstein and Nathan Goodman Griffiss AFB, N.Y. RADC May 1980 267 p refs
(Contract F30602-79-C-0191; AF Proj. 5581; AF Proj. 2530)
(AD-A087996; RADC-TR-80-158) Avail: NTIS HC A12/MF A01 CSCL 09/2

The state-of-the-art in distributed database concurrency control is consolidated. The heart of the analysis is a decomposition of the concurrency control problem into two major sub problems: read-write and write-write synchronization. A series of synchronization techniques for solving each sub-problem are described and it is shown how to combine synchronization techniques into algorithms that solve the entire concurrency control problem. Algorithms constructed in this way are called concurrency methods. Forty-eight principal concurrency control methods are

described. These methods include all practical algorithms for distributed database concurrency control that have appeared in the literature plus several new algorithms. In addition, an analysis of principal concurrency control methods in qualitative terms is performed. The analysis considers four cost factors: communication overhead, local processing overhead, transaction restarts, and transaction blocking. Results indicate that only about 10 of the principal concurrency control methods are reasonable choices in practice. Author

N80-33295# Naval Research Lab., Washington, D. C.
A HIGHLY PORTABLE DATA ACQUISITION SYSTEM FOR TOTAL MAGNETIC FIELD MEASUREMENTS Interim Report
Daniel Steiger 8 Aug. 1980 27 p refs
(AD-A088084; NRL-MR-4300) Avail: NTIS HC A03/MF A01 CSCL 09/2

At the Naval Research Laboratory, highly portable intelligent terminals are being utilized aboard oceanographic platforms for the acquisition and storage of total magnetic field measurements. The design and implementation of the data acquisition system which includes a detailed description of the hardware and software utilized is described. GRA

N80-33296# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
COMPLEXITY OF STORAGE AND RETRIEVAL PROBLEMS Final Report, 14 Jan. 1977 - 30 May 1980
Peter Elias 18 Jul. 1980 6 p refs
(Contract DAAG29-77-C-0012)
(AD-A088319; ARO-14649.2-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

This project has investigated the costs imposed by the need for communication between user and machine and between components of the machine in solving data-processing problems. There have been three principal substasks. The first, exploration of the minimal costs of storing and accessing information in simple data structures, is the oldest and results have been reported in several publications. The second is the design of minimax optimal universal codeword sets which can be used to represent any message set efficiently by assigning messages in order of decreasing probability to codewords in order of increasing length. A manuscript giving results of this research is almost ready for publication. The third is the exploration of switching networks which can be used for communication between a number of processors engaged in common computational task: that work is still in an early stage and is not yet ready for publication. GRA

N80-33297# Sandia Labs., Albuquerque, N. Mex. Distributed Processing System Design Div.
REMOTE HARD COPY. VOLUME 2: OPERATING MANUAL
Randall W. Simons Mar. 1980 22 p
(Contract DE-AC04-76DP-00789)
(SAND-80-0538/2) Avail: NTIS HC A02/MF A01

Procedures for operating the remote hard copy plotters are presented. Initializing the system, caring for the plotter, and interacting with the system are all covered. Descriptions of error conditions and how to operate diagnostics are presented. DOE

N80-33298# Sandia Labs., Albuquerque, N. Mex. Distributed Processing System Design Div.
REMOTE HARD COPY. VOLUME 1: PROGRAMMING MANUAL
Randall W. Simons Mar. 1980 13 p
(Contract DE-AC04-76DP-00789)
(SAND-80-0538/1) Avail: NTIS HC A02/MF A01

The application of various graphics languages and special control cards to create and route graphics files to the remote hard copy plotters is presented. Discussion and examples are given. DOE

N80-33299# Colorado Legislative Council, Denver.
COLORADO GENERAL ASSEMBLY SCIENCE AND TECHNOLOGY RESOURCE NEEDS ASSESSMENT STUDY Progress Report, Mar. 1978 - Aug. 1979
Floyd Mann Aug. 1979 247 p
(Contract NSF ISP-78-02517)
(PB80-189491; NSF/RA-790346) Avail: NTIS HC A11/MF A01 CSCL 05A

The Colorado General Assembly's needs for scientific and technological (S/T) resources was evaluated. Potentially useful ways to improve the Legislature's capacities to use S/T resources in its policy formulation, decisionmaking, and legislative processes are identified. A needs assessment survey found that between 14 and 27 percent of the bills introduced in a recent legislative session might require S/T expertise, knowledge, or research. Efforts to ascertain how needs for S/T inputs were made by Committee members and Legislative Research Council members ex post facto were unsuccessful. However, useful information was obtained on how inputs from S/T were perceived as technical or vested-interest inputs. GRA

N80-33300# Ohio Academy of Science, Columbus.
DEVELOPING SCIENCE AND TECHNOLOGY RESOURCES FOR THE GOVERNOR, OF THE OHIO SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM FOR EXECUTIVE AGENCIES Final Report
L. E. Elfner Nov. 1979 66 p refs Sponsored in part by Ohio Dept. of Economic and Community Development, Columbus
(Grant NSF ISP-78-02500)
(PB80-190101; NSF/RA-790413) Avail: NTIS HC A04/MF A01 CSCL 05A

Ways in which state and local governments can increase their capabilities for using science, engineering, and technology to meet the needs of their citizens are identified and analyzed. The results recommend the establishment of a five-part mechanism to assist the executive branch of the State government in the systematic, comprehensive, and ongoing use of Ohio's science, engineering, and technology resources in the State's policy making process. The mechanism comprises a resource coordinator, an agency resource advisory group, a council to provide direction, an annual science and government assembly, and the Ohio Academy of Science which assists agencies in establishing advisory groups. It is also recommended that science and technology resources be used most appropriately at the subcouncil level. GRA

N80-33301# New Jersey Dept. of Environmental Protection, Trenton.
THE SCIENCE, ENGINEERING, AND TECHNOLOGY PROGRAM FOR THE NEW JERSEY EXECUTIVE BRANCH
Aug. 1979 48 p
(Grant NSF ISP-78-13001)
(PB80-190242; NSF/RA-790419) Avail: NTIS HC A03/MF A01 CSCL 05A

Based on interviews and several case study analyses, the overall scheme for incorporating science, engineering, and technology (SET) resources into New Jersey policies is identified and qualitatively evaluated. Also, comparative research into formal mechanisms linking science, technology, and policy in other states is conducted, and recommendations are obtained from ten other states. The results reveal the absence of a central source to advise and inform the executive branch on SET issues. Few top administrators perceive a problem with access to or incorporation of SET information into policy and decision making. Recommendations include expansion of the Governor's office to include staff with SET capabilities and an increase in the number of top level administrators in state government who have a working knowledge of SET components. GRA

N80-33302# Department of Housing and Urban Development, Washington, D. C. Office of Policy Development and Research.
DATA RESOURCES IN HOUSING AND URBAN DEVELOPMENT
Mar. 1980 12 p
(PB80-188071; HUD/PDR-570; HUD-0001387) Avail: NTIS HC A02/MF A01 CSCL 05B

Data files available to the public from the Annual Housing Survey, the Survey of Development Needs of Small Cities, and the Survey on the Quality of Community Life are described. The Annual Housing Survey comprises two separate data collection efforts, a national survey of a sample of housing units and a survey of sample housing units in 15 Standard Metropolitan

Statistical Areas (SMSA's) each year, with a total of 60 selected SMSA's being surveyed every 4 years. GRA

N80-33303# Delaware Univ., Newark. Center for the Study of Marine Policy.
CREATING A SCIENCE AND TECHNOLOGY INFORMATION CAPACITY FOR THE EXECUTIVE AND LEGISLATIVE BRANCHES OF THE DELAWARE STATE GOVERNMENT Final Report
1 Oct. 1979 88 p refs
(Grant NSF ISP-78-02508)
(PB80-190762; NSF/RA-790421) Avail: NTIS HC A05/MF A01 CSCL 05A

Development of a mechanism for applying science and technology (S & T) to decision making within the executive and legislative branches of the State of Delaware was studied. The investigation involved assessing S & T needs of Delaware's General Assembly and Executive Branch, identifying S & T information resources within the State, reviewing S & T utilization experiences in other states, and developing an S & T information mechanism for Delaware. The mechanism that was developed uses professional societies within the State as an S & T resource. Successful models used by other states in developing an S & T program are included. GRA

N80-33304# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SYMPOSIUM ON INTERNATIONAL STANDARDS INFORMATION AND ISONET Final Report
Charles B. Phucas Jun. 1980 65 p Symp. held at Gaithersburg, Md., 11-12 Oct. 1979 Sponsored in part by ANSI, New York
(PB80-197221; NBS-SP-579; LC-80-600073) Avail: NTIS HC A04/MF A01 CSCL 05B

The American National Standards Institute (ANSI) and National Bureau of Standards working cooperatively with the International Organization for Standardization (ISO), provide United States input to the development of an International Standards Information Network called ISONET. Existing international standards information systems as well as the plans for the further development of ISONET are discussed. Developments in U.S. trade policy, especially those policies pertaining to standards and certification systems, are included. GRA

N80-33305# California Assembly Office of Research, Sacramento.
USE OF SCIENTIFIC AND TECHNICAL INFORMATION AND ADVICE BY THE CALIFORNIA LEGISLATURE: A SURVEY OF CURRENT POLICIES AND PROPOSALS FOR IMPROVEMENTS
Lawrence Marcus Baird Aug. 1979 131 p refs
(Grant NSF ISP-77-25862)
(PB80-189095; NSF/RA-790417) Avail: NTIS HC A07/MF A01 CSCL 05B

The information network used by the legislative staff to obtain scientific and technical knowledge and advice in their role as advisors to California legislators is described. The utility of proposed mechanisms to improve the scientific and technical capacity of the staff was assessed. A case study approach was used to analyze the past successes and failures of the Assembly Science and Technology Advisory Council. The results of a recent study based on interviews with California legislative leaders and the senior staff regarding perceptions of science and technology are compared with findings from the questionnaire used in this study. GRA

N80-33306# North Dakota Energy Management and Conservation Office, Bismarck.
APPLYING SCIENTIFIC AND TECHNOLOGICAL RESOURCES FOR NORTH DAKOTA POLICY DEVELOPMENT: STATE SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM Final Report
Clifford A. Ness, Jr. Sep. 1979 25 p refs
(Grant NSF ISP-78-04618)
(PB80-189624; NSF/RA-790418) Avail: NTIS HC A02/MF A01 CSCL 05B

The establishement of a scince and technology (S & T) resource system designed to improve access of North Dakota Statepolicymakers to S & T resources is described. The S & T system emerged from a realization that the current method of gathering S & T information by an informal ad hoc method should be replaced by a more formal structure to meet specific and expanding needs. S & T resource systems and practices in other states as well as in North Dakota were reviewed. GRA

N80-33307# Office of the Governor of the State of North Carolina, Raleigh.
THE STATE SCIENCE, ENGINEERING AND TECHNOLOGY PROGRAM IN NORTH CAROLINA, STUDY PHASE Final Report
31 Dec. 1979 57 p ref
(Grant NSF ISP-77-28878)
(PB80-190846; NSF/RA-790420) Avail: NTIS HC A04/MF A01 CSCL 05A

The development of the State Science, Engineering, and Technology (SSET) Program in North Carolina during 1963-79 is described. Various organizational arrangements for science and technology in state government are detailed. A Board of Science and Technology designed to simulate economic development in the state was created. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-33308* National Aeronautics and Space Administration, Washington, D. C.
FY 1981 BUDGET PRESS BRIEFING
26 Jan. 1980 25 p
(NASA-TM-82195; P80-10157) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 05C

The proposed FY-81 budget for the National Aeronautics and Space Administration is briefly described. The total NASA budget is approximately $5.7 billion for 1981, and the submittal includes a request for a FY-80 supplemental appropriation of $300 million for space shuttle development. Supported projects in astronomy, space exploration, space technology applications, and aeronautics are identified. M.G.

N80-33309# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1980. VOLUME 2, PART 2
Washington GPO 1979 317 p Hearings on H. R. 1786 before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 7, 14-15 Feb. 1979
(GPO-45-070) Avail: Subcommittee on Transportation, Aviation and Communication

Research in aerodynamics, structures and materials, propulsion and human factors engineering is discussed. Vehicle related technology is reviewed for transport aircraft: (1) energy efficient transport; (2) laminar flow control; (3) composite primary aircraft structures; (4) energy efficient engine; (5) advanced turboprop systems; and (6) terminal configured vehicle. Low and high speed aircraft are discussed. S.F.

N80-33310# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT - INDEPENDENT AGENCIES APPROPRIATIONS FOR 1981. PART 4: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington GPO 1980 1175 p Hearings before the Subcomm. on HUD-Independent Agencies of the Comm. on Appropriations, 96th Congr., 2nd. Sess., 28 Nov. 1979
(GPO-57-166) Avail: Subcommittee on HUD-Independent Agencies

Hearings before a subcommittee of the Committee on Appropriations are presented. Appropriations for NASA during the fiscal year 1981 are presented. T.M.

N80-33311# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1979, PART 1
Washington GPO 1978 513 p refs Hearings on S. 2527 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 95th Congr., 2nd Sess., 21-22 and 28 Feb. 1978
(GPO-25-603) Avail: Subcommittee on Science, Technology, and Space

The hearings before the Subcommittee on Science, Technology, and Space of the United States Senate are presented. Appropriations to NASA for research and development, construction of facilities, and operational costs during the 1979 fiscal year are presented. T.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

N80-33312*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
IMPROVED LOW-DRAG GROUND VEHICLE PARTICULARLY SUITED FOR USE IN SAFELY TRANSPORTING LIVESTOCK Patent Application
Edwin J. Saltzman, inventor (to NASA) Filed 5 Aug. 1980 15 p
(NASA-Case-FRC-11058-1; US-Patent-Appl-SN-175453) Avail: NTIS HC A02/MF A01 CSCL 13F

A low drag truck consisting of a tractor trailer rig characterized by a rounded forebody and a protective fairing for the gap conventionally found to exist between the tractor and the trailer is described. The truck is particularly suited for establishing an attached flow of ambient air along the vehicle surfaces by utilizing a forward facing, ram air inlet and duct and a plurality of submerged inlets and outflow ports which communicate with the trailer for continuously flushing heated gasses from the trailer as the rig is propelled at highway speeds. NASA

N80-33313*# IIT Research Inst., Chicago, Ill.
MANUFACTURING PROCESS APPLICATIONS TEAM (MATEAM) Quarterly Report, 1 May - 31 Jul. 1980
Edmund R. Bangs Aug. 1980 86 p Original contains color illustrations
(Contract NAS8-32229)
(NASA-CR-161577; IITRI-J6499-QR-2) Avail: NTIS HC A05/MF A01 CSCL 05A

Progress in the transfer of aerospace technology to solve key problems in the manufacturing sector of the economy is reported. Potential RTOP programs are summarized along with dissemination activities. The impact of transferred NASA manufacturing technology is discussed. Specific areas covered include aircraft production, robot technology, machining of alloys, and electrical switching systems. R.K.G.

N80-33314# British Carbonization Research Association, Chesterfield (England).
INVESTIGATION INTO THE USE OF HYDROGEN PEROXIDE FOR THE PURIFICATION OF CARBONIZATION WASTES
Jun. 1979 20 p
(BCRA-67; CRR-67) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Various liquors and liquor effluents were allowed to react for different periods with peroxide and the extent of purification was determined by simple analytical procedures. Hydrogen peroxide was not an economical method for the purification of spent liquors but, in the presence of a suitable catalyst, small amounts of peroxide gave good results with biologically treated effluents. A deterioration in the quality of the biological effluent resulted in an increased peroxide demand. The final effluent was inferior in quality to that obtained when the biological system was functioning efficiently. In the case of a biological effluent from the treatment of a pyrolysis waste, peroxide proved to be the only satisfactory method of further treatment. DOE

N80-33315# National Technical Information Service, Springfield, Va. Office of Internal Affairs.
A PLAN FOR A SYSTEM TO PROVIDE DEVELOPMENTAL INFORMATION IN AFRICA
John W. Hounsell Jun. 1980 44 p
(PB80-189806) Avail: NTIS HC A03/MF A01 CSCL 05B

The functions and components of an African information network that would provide scientific, technical, economic, social, and other information for development to planners, administrators, extension workers, businesses, and individuals is outlined. A mechanism to get information from numerous sources in developing and developed countries to end users in Africa is presented. Topics covered are training; user education; acquisition and dissemination of information; information subsidies; publications; evaluation; computerization; standardization of reference materials; coordination with other information and development organizations; conferences; and project funding. GRA

N80-33316# Environmental Protection Agency, Chicago, Ill. Great Lakes National Program Office.
PROCEEDINGS OF NATIONAL CONFERENCE ON URBAN EROSION AND SEDIMENT CONTROL: INSTITUTIONS AND TECHNOLOGY
William L. Downing Jan. 1980 375 p refs Conf. held in St. Paul, 10-12 Oct. 1980
(PB80-197965; EPA-905/9-80-002) Avail: NTIS HC A16/MF A01 CSCL 08M

Urban erosion and sediment control are discussed. Land management techniques, social and institutional structures, and other mechanisms by which soil erosion and water problems may be reduced to acceptable levels are included. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-33317*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TECHNIQUES FOR MEASURING ARRIVAL TIMES OF PULSAR SIGNALS 1: DSN OBSERVATIONS FROM 1968 TO 1980
G. S. Downs and P. E. Reichley 15 Aug. 1980 88 p refs
(Contract NAS7-100)
(NASA-CR-163564; JPL-Pub-80-54) Avail: NTIS HC A05/MF A01 CSCL 03A

Techniques used in the ground based observations of pulsars are described, many of them applicable in a navigation scheme. The arrival times of the pulses intercepting Earth are measured at time intervals from a few days to a few months. Low noise, wide band receivers, amplify signals intercepted by 26 m, 34,

and 64 m antennas. Digital recordings of total received signal power versus time are cross correlated with the appropriate pulse template. S.F.

N80-33318*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERFERENCE FILTER PHOTOMETRY OF PERIODIC COMET ASHBROOK-JACKSON
R. L. Newburn, Jr., J. F. Bell, and T. B. McCord Aug. 1980 30 p refs Prepared in cooperation with Hawaii Univ. at Manoa
(Contracts NAS7-100; JPL-699908)
(NASA-CR-163581; JPL-9950-418) Avail: NTIS HC A03/MF A01 CSCL 03A

P/Ashbrook-Jackson has a period of 7.43 years and comes to perihelion at 2.284 AU. It is a low inclination object (12.5 deg) of moderate eccentricity (0.400). In 1963, it made the best possible apparition, coming to perihelion and opposition virtually simultaneously, but no one made physical observations of faint periodic comets in 1963. In 1978 Ashbrook-Jackson came to opposition on Sept. 28, just 40 days after perihelion. It will be just over 100 years before an equally favorable apparition recurs. P/Ashbrook-Jackson was recovered by Pereyra at Cordoba Observatory on April 28, 1977, more than a year and a quarter before perihelion and already showing a diffuse coma with central condensation. Its helio-centric distance was then 3.7 AU. An extensive program was planned, but equipment problems and weather ultimately limited it to the two nights of data reported here. R.K.G.

N80-33319*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electro-Optics Lab.
LARGE DEPLOYABLE REFLECTOR (LDR) Final Report
W. H. Aiff Jul. 1980 124 p refs
(Contract NAS2-10427)
(NASA-CR-152402; LMSC-D766449) Avail: NTIS HC A06/MF A01 CSCL 03A

The feasibility and costs were determined for a 1 m to 30 m diameter ambient temperature, infrared to submillimeter oribiting astronomical telescope which is to be shuttle-deployed, free-flying, and have a 10 year orbital life. Baseline concepts, constraints on delivery and deployment, and the sunshield required are examined. Reflector concepts, the optical configuration, alignment and pointing, and materials are also discussed. Technology studies show that a 10 m to 30 m diameter system which is background and diffraction limited at 30 micron m is feasible within the stated time frame. A 10 m system is feasible with current mirror technology, while a 30 m system requires technology still in development. A.R.H.

N80-33320*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OBSERVATIONS AND ANALYSIS OF X-RAY BINARY STARS UNDER THE IUE GUEST OBSERVER PROGRAM Final Report, 1 Oct. 1977 - 30 Apr. 1979
Herbert Gursky Jun. 1979 4 p
(Contract NAS5-24332)
(NASA-CR-160035) Avail: NTIS HC A02/MF A01 CSCL 03A

IUE data for X-ray binaries were collected and analyzed. Image processing was done for 144 IUE images. The images represent 27 different objects. T.M.

N80-33321# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TOTAL GAMMA ABSORPTION TELESCOPE WITH MULTI-PARAMETRIC ANALYSIS [TELESCOPIO GAMA A ABSORCAO TOTAL E ANALISE MULTIPARAMETRICA]
Daniel Jean Roger Nordemann, Jose Marques DaCosta, and Inacio Malmonge Martin Jun. 1980 17 p refs In PORTUGUESE; ENGLISH summary Presented at the 32d Reuniao Anual da SBPC, 6-12 Jul. 1980 Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico
(INPE-1804-RPE/172) Avail: NTIS HC A02/MF A01

The present tendency of gamma ray astronomy is to build high performance telescopes using large detectors Ge(Li) and HPGe with anticoincidence system. A similar and competitive type of telescope using the principle of total absorption can be constructed with a large number of smaller detectors. This telescope would allow a better definition of the astrophysical sources. Such an apparatus would require more telemetry channels and more memory yet its price is lower than those of present gamma ray telescope projects. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-33322# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION OF 511 KeV ANNIHILATION LINE FROM THE DIRECTION OF THE GALACTIC CENTER
J. M. daCosta, S. L. G. Dutra, Ph. Durouchoux, D. Boclet, R. Rocchia, F. Albernhe, J. F. LeBorgne, and G. Vedrenne Aug. 1980 16 p refs Prepared in cooperation with Commissariat a L'Energie Atomique, Saclay, France and Centre d'Etudes Spatiale des Rayonnements
(INPE-1863-RPE/213) Avail: NTIS HC A02/MF A01

A balloon borne Ge(li) detector was used in four low energy gamma ray experiments flown from Guaratinguets, Brazil. Analysis of the gamma ray spectra obtained on two dates shows an intensity of (4.19 ± or - 1.56) x 10 to the minus 3 power photons/sq cm/s for the flux of the 511 KeV annihilation from the galactic center direction. A.R.H.

N80-33323# California Univ., Livermore. Lawrence Livermore Lab.
SUPERNOVA MODELS AND LIGHT CURVES
Thomas A. Weaver and S. E. Woosley (California Univ., Santa Cruz) 1980 19 p refs Presented at the Workshop on Atomic Phys. and Spectry. for Supernovae Spectra, San Diego, Calif., 10-12 Jan. 1980 Submitted for publication
(Contract W-7405-eng-48; Grant NSF AST-79-09102)
(UCRL-84578; CONF-800126-3) Avail: NTIS HC A02/MF A01

The current status of understanding of Type 2 supernovae is reviewed with particular emphasis on the processes responsible for the emission of electromagnetic radiation. A relatively novel evolutionary scenario that appears to lead to a Type 1 supernova explosion is also presented. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-33324* National Aeronautics and Space Administration, Washington, D. C.
SURFACE OF VENUS FROM PIONEER
28 May 1980 58 p
(NASA-TM-82193; PB0-101154) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 03B

Radar data of the Venusian surface from the Pioneer Venus 1 are informally discussed. From the altimetry standpoint, the data are good to within 200 meters; the images have approximately a 30 km resolution with the altitude points being spaced 75 km in longitude and 100 km in latitude. Geological interpretations are offered based on the Pioneer data in conjunction with ground based radar and altimetry data. A 'plains' area is identified representing 65% of the planet which lies within 2 km of the nominal mean elevation. Three highland areas are identified and discussed. Venus has only 30% lowland as compared to the Earth's 75%. The high mountains are as high as the highest mountains on Earth, and the high plateaus are higher than the

greatest plateaus on Earth. Signs of regional tectonic motion are also discussed. M.G.

N80-33326*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SURVEY OF THE PLASMA ELECTRON ENVIRONMENT OF JUPITER: A VIEW FROM VOYAGER
Jack D. Scudder, Edward C. Sittler, Jr., and H. S. Bridge (MIT, Cambridge) Aug. 1980 91 p refs Submitted for publication (NASA-TM-80731) Avail: NTIS HC A05/MF A01 CSCL 03B

The plasma environment within Jupiter's bow shock is considered in terms of the in situ, calibrated electron plasma measurements made between 10 eV and 5.95 keV by the Voyager plasma science experiment (PLS). Measurements were analyzed and corrected for spacecraft potential variations; the data were reduced to nearly model independent macroscopic parameters of the local electron density and temperature. It is tentatively concluded that the radial temperature profile within the plasma sheet is caused by the intermixing of two different electron populations that probably have different temporal histories and spatial paths to their local observation. The cool plasma source of the plasma sheet and spikes is probably the Io plasma torus and arrives in the plasma sheet as a result of flux tube interchange motions or other generalized transport which can be accomplished without diverting the plasma from the centrifugal equator. The hot suprathermal populations in the plasma sheet have most recently come from the sparse, hot mid-latitude 'bath' of electrons which were directly observed juxtaposed to the plasma sheet. A.R.H.

N80-33328*# RAND Corp., Santa Monica, Calif.
COORDINATES OF FEATURES ON THE GALILEAN SATELLITES
Merton E. Davies and Frank Y. Katayama Jun. 1980 39 p refs
(Contracts NASw-3210; JPL-953613)
(NASA-CR-163582; RAND/P-6479) Avail: NTIS HC A03/MF A01 CSCL 03B

The coordinate systems of each of the Galilean satellites are defined and coordinates of features seen in the Voyager pictures of these satellites are presented. The control nets of the satellites were computed by means of single block analytical triangulations. The normal equations were solved by the conjugate iterative method which is convenient and which converges rapidly as the initial estimates of the parameters are very good. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-33327* National Aeronautics and Space Administration, Washington, D. C.
SOLAR MAXIMUM MISSION
8 Feb. 1980 29 p
(NASA-TM-82192; PB0-10153) Avail: NASA Scientific and Technical Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 03B

Mission objectives are described as well as the seven instruments carried onboard the multimission modular spacecraft to study solar activity and monitor the solar constant. Possibilities of retrieval and servicing by space shuttle are discussed and solar terrestrial interactions are examined with application to recent events in the United States. A.R.H.

N80-33328# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
TWO PAPERS ON THE METHODS OF EVALUATING THE QUALITY OF SOLAR PROTON EVENT FORECASTING FROM THE PEOPLE'S REPUBLIC OF CHINA
Zhen-xing Cui and Shan-Jie Qian 25 Oct. 1979 19 p Transl. into ENGLISH from Acta Astron. Sinica (China), v. 16, no. 1, 1976 p 6-11, 115-117
(AF Proj. 2311)
(AD-A088154; AFGL-TR-79-0250; AFGL-Trans-110) Avail: NTIS HC A02/MF A01 CSCL 03/2

The common criteria used to evaluate the accuracy of solar proton event forecasts and discuss their defects is reviewed. The concept of random forecast is introduced, and a combined indictor which can give a more reasonable assessment of the quality of forecasts is proposed. An improved indicator for evaluating the quality of solar proton event forecasts is included. S.F.

N80-33329# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 427, MARCH 1980, PART 1 (PROMPT REPORTS) Progress Report, Jan. - Feb. 1980
Helen E. Coffey, ed. Mar. 1980 167 p refs
(PB80-194871; SGD-427-Pt-1; NOAA-80043002) Avail: NTIS HC A08/MF A01 CSCL 03B

Data for February 1980 on alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, coronal holes and Boulder Geomagnetic Substorm Log is reported. Data for January 1980 on daily solar activity center, sudden ionospheric disturbances, solar radio emission, cosmic rays, geomagnetic indices and radio propagation indices is also provided. Late data included in this issue presents solar flares January 1980, cosmic rays - October and December 1979, and geomagnetic indices December 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-33330# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A 2.2 MeV GAMMA RAY LINE OBSERVED DURING A SN SOLAR FLARE
K. R. Rao, I. M. Martin, J. O. D. Jardim, and U. B. Jayanthi Aug. 1980 14 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1842-RPE/202) Avail: NTIS HC A02/MF A01

On December 15, 1978, an omnidirectional gamma ray detector was flown during day time. Around noon time, when the sun was in the field of view of the detector, a solar flare of magnitude SN was observed. The flux of 2.2 MeV line showed enhancement during this period whereas at other times only upper limit was obtained. R.K.G.

N80-33331# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SCALE SIZE OF THE COSMIC RAY MODULATING REGION
R. P. Kane Jul. 1980 15 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Technologico
(INPE-1826-RPE/192) Avail: NTIS HC A02/MF A01

The effects of using monthly means in the analysis of long term changes of cosmic ray intensity are examined. It is shown that these can have considerable pollution from Forbush decrease effects. In particular, a use of maximum daily mean in a month, instead of the monthly mean, seems to reduce the width of the hysteresis loops, thereby implying reduced dimensions of the modulating region for galactic cosmic ray intensity. M.G.

N80-33332*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTROSCOPY OF COMPACT EXTRAGALACTIC X-RAY SOURCES
Stephen S. Holt Sep. 1980 16 p refs Presented at the HEAD Meeting, AAS, Cambridge, Mass., Jan. 1980
(NASA-TM-82010) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray spectra of compact extragalactic sources obtained from the HEAO-1 A-2 experiment and the solid-state spectrometer

onboard HEAO-2 (the Einstein Observatory) are reviewed. Seyfert spectra are remarkably consistent with characteristic power-law spectra of energy index alpha = 0.7 + .1 over a dynamic range of almost 100 in both luminosity for the whole sample, and energy for individual members. Radio-quiet quasars have similar spectra, perhaps slightly steeper, for the limited sample available. New solid-state spectrometer results for NGC 4151 yield a consistent picture for the geometry of the broad-line clouds in both these related radio-quiet classes of galactic nuclei. Radio-loud objects, especially BL Lacs, are considerably more variable in spectrum as well as luminosity. Direct synchrotron and synchrotron-self-Compton components are consistent with what we observe from these objects. Finally, the role of spectroscopy in addressing the extent to which compact extragalactic nuclei might contribute to the diffuse X-ray background is discussed. Author

N80-33333*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HEAVY WEAK BOSONS, COSMIC ANTIMATTER AND DUMAND. 2: LOOKING FOR COSMIC ANTIMATTER WITH DUMAND

F. W. Stecker and R. W. Brown (Case Western Reserve Univ., Cleveland) Sep. 1980 17 p refs Presented at 1980 DUMAND Summer Workshop Submitted for publication

(NASA-TM-82017) Avail: NTIS HC A02/MF A01 CSCL 03B

Discussion of various means for using high energy neutrino astronomy to directly test for the existence of cosmic antimatter on a significant cosmological scale is presented. Studies of the ultrahigh energy diffuse neutrino background using acoustic detector and high mass Glashow resonances are reported. Point source studies are also discussed. R.K.G.

N80-33334*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.

ONE MILLIMETER CONTINUUM OBSERVATIONS OF EXTRAGALACTIC THERMAL SOURCES

Thomas Leonard Roellig [1980] 168 p refs

(Grant NsG-2347)

(NASA-CR-163590; CRSR-753) Avail: NTIS HC A08/MF A01 CSCL 03B

The results of 1 mm observations of extragalactic thermal sources are reported. The methods of making 1 mm observations are described. The instrumentation used to make the observation is described. T.M.

N80-33335# California Univ., Livermore. Lawrence Livermore Lab. Physics Dept.

ANOMALOUS ISOTOPIC COMPOSITION OF COSMIC RAYS

S. E. Woosley (California Univ., Santa Cruz) and Thomas A. Weaver 20 Jun. 1980 21 p refs Presented at the Astrophys. Workshop, Santa Cruz, Calif., 7-18 Jul. 1980

(Contract W-7405-eng-48)

(UCRL-84561; CONF-800728-1) Avail: NTIS HC A02/MF A01

Measurements of nonsolar isotopic patterns for the elements neon and (perhaps) magnesium in cosmic rays are interpreted within current models of stellar nucleosynthesis. One possible explanation is that the stars currently responsible for cosmic ray synthesis in the Galaxy are typically super-metal-rich by a factor of two or three. Other possibilities include the selective acceleration of certain zones or masses of supernovas or the enhancement of (22)Ne in the stellar medium by mass loss from red giant stars and planetary nebulas. Measurements of critical isotopic ratios are suggested to aid in distinguishing among the various possibilities. Some of these explanations place significant constraints on the fraction of cosmic ray nuclei that must be fresh supernova debris and the masses of the supernovas involved. DOE

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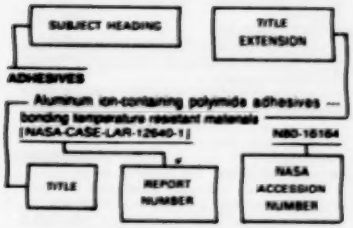

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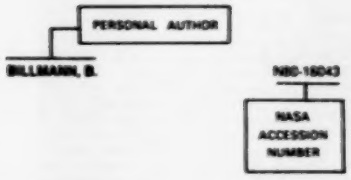

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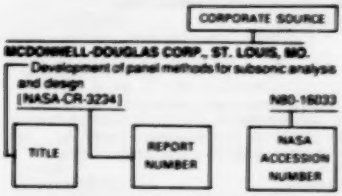

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Quantitative gas analysis of sulfur dioxide in nitrogen by Fourier transform infrared spectrophotometer
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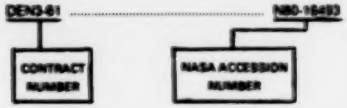

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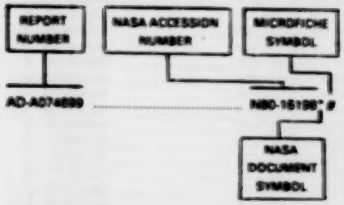

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CM/CCM-79-5 ..... N80-32624 #

CMC-C8178-PR-017 ..... N80-32944 #

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CONF-791045-8 ..... N80-32510 #
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CONF-791204-37 ..... N80-32559 #
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CONF-791216-3 ..... N80-32900 #
CONF-800126-3 ..... N80-33323 #
CONF-800204-9 ..... N80-32553 #
CONF-800240-1 ..... N80-32744 #
CONF-800320-5 ..... N80-32464 #
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CONF-800352-4 ..... N80-32947 #
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CONF-800373-1 ..... N80-32863 #
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CONF-800439-7 ..... N80-33238 #
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CONF-800446-2-REV-1 ..... N80-33237 #
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CONF-800481-1 ..... N80-32926 #
CONF-800507-6 ..... N80-32797 #
CONF-800542-4 ..... N80-32597 #
CONF-800549-2 ..... N80-32901 #
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CONF-800567-2 ..... N80-32562 #
CONF-800571-1 ..... N80-33165 #
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CONF-800575-2 ..... N80-32745 #
CONF-800587-1 ..... N80-32682 #
CONF-800587-4 ..... N80-32507 #
CONF-800590-1 ..... N80-33205 #
CONF-800604-25 ..... N80-32916 #
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CONF-800610-7 ..... N80-32483 #
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CONF-800638-1 ..... N80-33119 #
CONF-800640-8 ..... N80-32684 #
CONF-800641-2 ..... N80-32795 #
CONF-800641-4 ..... N80-32794 #
CONF-800644-1 ..... N80-33148 #
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CONF-800661-1 ..... N80-32730 #
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CONF-800707-2-REV-1 ..... N80-33234 #
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CONF-800707-4 ..... N80-33236 #
CONF-800707-5 ..... N80-33241 #
CONF-800707-6 ..... N80-33235 #
CONF-800707-6-REV-1 ..... N80-33250 #
CONF-800707-11 ..... N80-33248 #
CONF-800707-12 ..... N80-33249 #
CONF-800714-1 ..... N80-32550 #
CONF-800719-6 ..... N80-32936 #
CONF-800720-1 ..... N80-33115 #
CONF-800723-6 ..... N80-32714 #
CONF-800728-1 ..... N80-33335 #
CONF-800732-1 ..... N80-32585 #
CONF-800734-1 ..... N80-33277 #
CONF-800801-5 ..... N80-32506 #
CONF-800802-3 ..... N80-32911 #
CONF-800802-4 ..... N80-32961 #
CONF-800804-5 ..... N80-32746 #
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CONF-800804-10 ..... N80-32792 #
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CONF-800806-15 ..... N80-32940 #
CONF-800806-19 ..... N80-32941 #
CONF-800806-22 ..... N80-32874 #
CONF-800806-27 ..... N80-32955 #
CONF-800806-29 ..... N80-32573 #
CONF-800808-3 ..... N80-32485 #
CONF-800810-1 ..... N80-32715 #
CONF-800814-1 ..... N80-32530 #
CONF-800814-2 ..... N80-32529 #
CONF-800816-1 ..... N80-33274 #
CONF-800818-1 ..... N80-33208 #
CONF-800820-3 ..... N80-33164 #
CONF-800914-2 ..... N80-33245 #
CONF-7909100-2 ..... N80-33279 #
CONF-7910166-5 ..... N80-33044 #

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COO-2363-0063 ..... N80-33145 #
COO-2749-43-VOL-2 ..... N80-32719* #
COO-2892-18 ..... N80-33192 #
COO-3162-51 ..... N80-33078 #
COO-4020-10 ..... N80-33243 #
COO-4386-10 ..... N80-32545 #
COO-4386-11 ..... N80-32563 #
COO-4484-07 ..... N80-32952 #
COO-4552-2 ..... N80-33089 #
COO-4649-10 ..... N80-32906 #
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CRC-APRAC-CAPA-15-76A-VOL-1 ..... N80-33045 #

CRR-67 ..... N80-33314 #

CRREL-80-10 ..... N80-32580 #

CRSR-753 ..... N80-33334* #

CSU-TR-N-80-1 ..... N80-33259 #

CSU-TR-1 ..... N80-33151 #

CW-WR-78-02-0-44A ..... N80-32721 #

C80-1337/034C ..... N80-32390 #

DCIEM-TR-80-R-26-REV ..... N80-33100 #

DELET-TR-74-C-0605-F ..... N80-32665 #
DELET-TR-78-2996-2 ..... N80-32674 #
DELET-TR-78-3007-1 ..... N80-32675 #
DELET-TR-78-8996-1 ..... N80-32673 #
DELET-TR-79-0254-1 ..... N80-33272 #
DELET-TR-79-0272-1 ..... N80-33268 #
DELET-TR-80-7 ..... N80-32662 #
DELET-TR-80-8 ..... N80-32667 #
DELET-TR-80-9 ..... N80-32663 #
DELET-TR-80-10 ..... N80-32677 #

DG-501-79-VOL-3 ..... N80-32415 #

DNA-4216T-3 ..... N80-32625 #

DOE-ET-20071/T1 ..... N80-32546 #
DOE-ET-21050-1-2 ..... N80-32668 #
DOE-ET-21050/1-1 ..... N80-32667 #

DOE/CH-00178-T2 ..... N80-32934 #

DOE/CS-0165 N80-32548 #
DOE/CS-0188 N80-32988 #
DOE/CS-04239/T1 N80-32944 #
DOE/CS-04270/1 N80-32954 #
DOE/CS-153982/1 N80-32527 #
DOE/CS-40163/T1 N80-32902 #
DOE/CS-40178/01-VOL-1 N80-33288 #

DOE/DP-03823/T1-VOL-1 N80-32957 #
DOE/DP-03533/T3 N80-32950 #
DOE/DP-40039 N80-33247 #

DOE/EIA-CR-0456 N80-32869 #

DOE/EIA-10587/T1 N80-33112 #

DOE/ER-01199/1307 N80-33281 #
DOE/ER-01199/1314 N80-32588 #
DOE/ER-01199/1318 N80-33284 #
DOE/ER-01398-444 N80-33193 #
DOE/ER-02186 N80-33280 #
DOE/ER-04857/2 N80-32896 #
DOE/ER-05002/8 N80-33279 #
DOE/ER-05002/9 N80-32510 #
DOE/ER-05773/2 N80-32478 #
DOE/ER-10436/1 N80-33283 #
DOE/ER-10456/1 N80-32473 #
DOE/ER-10474/1 N80-32724 #
DOE/ER-10501/1 N80-32500 #

DOE/ET-12328/T1 N80-32474 #
DOE/ET-13151/T5 N80-32725 #
DOE/ET-14102-2 N80-32587 #
DOE/ET-15207/T1 N80-32703 #
DOE/ET-15320/T1 N80-32732 #
DOE/ET-20090/3 N80-32929 #
DOE/ET-20279/92 N80-32874 #
DOE/ET-20279/93 N80-32914 #
DOE/ET-20419/1 N80-32892 #
DOE/ET-20550/1 N80-32945 #
DOE/ET-21050/1-3-VOL-3 N80-32893 #
DOE/ET-21074/4 N80-32921 #
DOE/ET-23006/3 N80-32915 #
DOE/ET-23007/1 N80-32919 #
DOE/ET-23010/17 N80-32932 #
DOE/ET-23044/4 N80-32920 #
DOE/ET-23108/2 N80-32923 #
DOE/ET-25502/1 N80-32878 #
DOE/ET-28931/T1 N80-32897 #
DOE/ET-33021/T1 N80-32930 #

DOE/EV-0079 N80-32972 #
DOE/EV-0084 N80-32969 #
DOE/EV-02366/1 N80-32436 #

DOE/FE-0003/79-2 N80-32574 #
DOE/FE-0004/79-2 N80-32555 #
DOE/FE-2614/3 N80-32943 #

DOE/IA-0010 N80-32918 #

DOE/JPL-1012-44 N80-32852* #
DOE/JPL-954739-3 N80-32857* #
DOE/JPL-955614-80/1 N80-32855* #

DOE/NASA/1040-15 N80-32488* #
DOE/NASA/1082-6 N80-33221* #
DOE/NASA/2749-79/2-VOL-2 N80-32719* #
DOE/NASA/23139-1 N80-32658* #

DOE/RA-2134/01 N80-32679 #

DOE/SR/SF-2004-REV-1 N80-33199 #

DOE/TIC-11190 N80-32928 #

DOT-HS-805130 N80-32734 #
DOT-HS-805132 N80-32737 #
DOT-HS-805133 N80-32736 #
DOT-HS-805239 N80-32735 #

DOT-TSC-NHTSA-79-38 N80-32734 #
DOT-TSC-NHTSA-79-40 N80-32735 #
DOT-TSC-NHTSA-79-52 N80-32737 #
DOT-TSC-NHTSA-79-53 N80-32736 #

DP-MS-79-51 N80-33070 #

DRSMI-RE-CR-80-12 N80-32841 #

DRSMI-RL-CR-80-3 N80-32408 #

DRSMI-RL-80-7-TR N80-32447 #

DRSMI-RR-80-3-TR N80-32617 #

DRXTH-IS-TR-80057 N80-32534 #

DSA-248 N80-32621 #

DSE-4042-T18 N80-32925 #
DSE-4042-T41 N80-32884 #
DSE-4043-T42 N80-32931 #
DSE-5235-T1 N80-32913 #

DT-7909-14 N80-32351 #

DTNSRDC-80/012-REV-1 N80-32582 #
DTNSRDC-80/058 N80-32382 #
DTNSRDC-80/064 N80-32695 #
DTNSRDC-80/098 N80-32380 #
DTNSRDC-80/104 N80-32348 #

DTNSRDC/AERO-1266 N80-32382 #
DTNSRDC/AERO-1268 N80-32348 #

DTNSRDC/ASED-AERO-1269 N80-32380 #

DTNSRDC/ASED-80/09 N80-32347 #
DTNSRDC/ASED-80/10-VOL-1 N80-32341 #
DTNSRDC/ASED-80/12-VOL-2 N80-32342 #

DYNATECH-2013 N80-32583 #

D180-25234-1 N80-32405* #
D210-11555-1 N80-32384 #

E-041 N80-32489* #
E-372 N80-32396* #
E-440 N80-32658* #
E-453 N80-32487* #
E-486 N80-32488* #
E-511-REV N80-32394* #
E-514 N80-33221* #
E-531 N80-32395* #
E-535 N80-32587* #
E-541 N80-32689* #
E-549 N80-32970* #
E-565 N80-33104* #
E-566 N80-32610* #
E-576 N80-32753* #
E-581 N80-32428* #
E-585 N80-32808* #
E-600 N80-32486* #

EEB-VENT-80-9 N80-32595 #
EEB-VENT-80-15 N80-32984 #

EML-374 N80-32978 #

EOARD-TR-80-11 N80-33217 #
EOARD-TR-80-13 N80-32458 #
EOARD-TR-80-14 N80-33140 #

EPA-AA-IMS/ST-80-4 N80-33018 #

EPA-AA-TEB-80-5 N80-33008 #

EPA-450/4-79-025-VOL-1 N80-33009 #
EPA-450/5-80-006 N80-33005 #
EPA-460/3-80-003 N80-33017 #
EPA-460/3-80-004 N80-33020 #
EPA-460/3-80-005 N80-33012 #
EPA-460/3-80-006 N80-33013 #
EPA-560/13-80-014 N80-32483 #
EPA-600/2-79-182 N80-33015 #
EPA-600/2-79-201 N80-32994 #
EPA-600/2-80-006 N80-32985 #
EPA-600/2-80-034 N80-33010 #
EPA-600/2-80-038 N80-33016 #
EPA-600/2-80-069 N80-32577 #
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EPA-600/3-80-041 N80-32997 #
EPA-600/3-80-042 N80-32979 #
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EPA-600/7-80-034 N80-33019 #
EPA-600/7-80-076 N80-33006 #
EPA-600/7-80-077 N80-33011 #
EPA-600/7-80-081 N80-32706 #
EPA-600/7-80-083 N80-33000 #

EPA-600/7-80-091 N80-32479 #
EPA-600/7-80-093 N80-32995 #
EPA-600/8-80-024 N80-33007 #
EPA-600/9-80-004 N80-33014 #
EPA-600/9-80-015 N80-33004 #
EPA-905/4-79-028 N80-32993 #
EPA-905/9-80-002 N80-33318 #

EPRI-AP-1318 N80-32881 #
EPRI-AP-1345 N80-32864 #
EPRI-AP-1389 N80-32504 #

EPRI-EA-1377 N80-32987 #

EPRI-EL-909-SY N80-32880 #
EPRI-EL-1300 N80-32681 #

EPRI-EM-1329 N80-32877 #
EPRI-EM-1333 N80-32866 #
EPRI-EM-1417 N80-32917 #

EPRI-NP-1407 N80-32798 #

ERC41016.15RF N80-32674 #
ERC41016.91RF N80-32673 #

ERIM-132400-41-T N80-32809* #

ERL-0124-TR N80-32444 #

ESD-TR-79-346 N80-33213 #
ESD-TR-79-348 N80-33257 #
ESD-TR-80-29 N80-32643 #

EUR-6696-EN N80-32939 #
EUR-6711-DE N80-32733 #

EXXON/GRU.18GFGS.79 N80-32989 #

E80-10296 N80-32805* #
E80-10310 N80-32806* #
E80-10312 N80-32807* #
E80-10313 N80-32808* #
E80-10314 N80-32809* #
E80-10317 N80-32810* #
E80-10319 N80-32811* #
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E80-10323 N80-32814* #
E80-10324 N80-32815* #
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E80-10330 N80-32821* #
E80-10331 N80-32822* #
E80-10332 N80-32823* #
E80-10333 N80-32824* #
E80-10337 N80-32825* #
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FAA-AM-80-3 N80-32356 #

FAA-ASP-80-2-VOL-1 N80-32355 #

FAA-CT-79-55 N80-33065 #
FAA-CT-80-189 N80-32372 #
FAA-CT-80-191 N80-32373 #

FAA-EE-80-12 N80-32537 #

FAA-EM-79-16 N80-32371 #

FAA-MS-80-5 N80-32325 #

FAA-RD-79-109 N80-32594 #
FAA-RD-80-23 N80-33065 #
FAA-RD-80-37 N80-32367 #
FAA-RD-80-60 N80-32368 #
FAA-RD-80-83 N80-32372 #
FAA-RD-80-84 N80-32373 #

FDA/BMD-80/75 N80-33079 #

FE-1514-113 N80-32557 #
FE-1806-83 N80-32729 #
FE-1806-84 N80-32728 #
FE-2018-14 N80-32475 #
FE-2018-15 N80-32471 #

FE-2018-18 ..... N80-32470 #
FE-2034-18 ..... N80-32558 #
FE-2291-44A ..... N80-32721 #
FE-2305-30 ..... N80-32568 #
FE-2468-85 ..... N80-33157 #
FE-2595-5 ..... N80-32569 #
FE-2621-13 ..... N80-32726 #
FE-2689-T4 ..... N80-32543 #
FE-2702-10 ..... N80-32556 #
FE-3177-5 ..... N80-32472 #

FHWA/IN/JHRP-79/16 ..... N80-32602 #

FHWA/RD-79/30 ..... N80-32603 #
FHWA/RD-79/109 ..... N80-32601 #

FHWA/VA-80/36 ..... N80-32600 #

FJSRL-TR-80-0015 ..... N80-32542 #

FR-2-PT-2 ..... N80-32830* #
FR-13168-VOL-1 ..... N80-32431* #
FR-13168-VOL-2 ..... N80-32432* #

FRA/ORD-78/299 ..... N80-32575 #
FRA/ORD-78/300 ..... N80-32576 #

FRC-C4772-2 ..... N80-32952 #

FSU-STATISTICS-M552 ..... N80-33159 #

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GA-A-15788 ..... N80-32469 #

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GDC-CRAD-80-014 ..... N80-32412* #

GJBX-26(80) ..... N80-32940 #

GLBC/GLEPS-14 ..... N80-32998 #

GPO-25-603 ..... N80-33311 #
GPO-40-611 ..... N80-32365 #
GPO-45-070 ..... N80-33309 #
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H-1096 ..... N80-32389* #
H-1125 ..... N80-32329* #

HAC-FR-80-23-919R ..... N80-32630 #

HAC-REF-E5599 ..... N80-32630 #

HDL-TM-80-2 ..... N80-32614 #
HDL-TM-80-13 ..... N80-33128 #
HDL-TM-80-14 ..... N80-33097 #

HEDL-SA-1927 ..... N80-32803 #
HEDL-SA-1979 ..... N80-32512 #
HEDL-SA-2145-FP ..... N80-33207 #
HEDL-SA-2147-FP ..... N80-33282 #
HEDL-SA-2149 ..... N80-32531 #

HEDL-TME-78-55-VOL-2 ..... N80-33273 #

HH-80-125 ..... N80-32591 #

HONEYWELL-80SRC25 ..... N80-33212 #

HUD-0001367 ..... N80-33302 #
HUD-0001443 ..... N80-32961 #

HUD/PDR-570 ..... N80-33302 #

IAEA-CN-38/E-2 ..... N80-33244 #
IAEA-CN-38/F-4 ..... N80-33234 #
IAEA-CN-38/R-2 ..... N80-33235 #
IAEA-CN-38/S-1 ..... N80-33236 #

IBM-80-D68-001 ..... N80-33118 #

IDA-P-1399 ..... N80-32627 #

IDA/HQ-79-21012 ..... N80-32627 #

IINR-79/22 ..... N80-32992 #

IITRI-J6499-OR-2 ..... N80-33313* #

IKE-K-54-20-PT-1 ..... N80-32974 #

IN-80-FM-47 ..... N80-32426* #
IN-80-FM-50 ..... N80-32411* #

INPE-1691-RPE/119 ..... N80-33052 #
INPE-1750-RPE/143 ..... N80-33053 #
INPE-1757-RPE/146 ..... N80-33049 #
INPE-1758-RPE/147 ..... N80-33030 #
INPE-1759-RPE/148 ..... N80-33028 #
INPE-1761-RPE/150 ..... N80-33050 #
INPE-1762-RPE/151 ..... N80-33253 #
INPE-1763-RPE/152 ..... N80-33252 #
INPE-1764-RPE/153 ..... N80-33189 #
INPE-1784-RPE/156 ..... N80-32832 #
INPE-1785-RPE/157 ..... N80-33106 #
INPE-1790-RPE/162 ..... N80-32835 #
INPE-1792-RPE/164 ..... N80-32837 #
INPE-1793-RPE/165 ..... N80-32833 #
INPE-1794-RPE/166 ..... N80-32836 #
INPE-1797-RPE/167 ..... N80-32831 #
INPE-1798-RPE/168 ..... N80-33029 #
INPE-1800-RPE/170 ..... N80-33031 #
INPE-1801-RPE/171 ..... N80-33032 #
INPE-1804-RPE/172 ..... N80-33321 #
INPE-1806-RPE/174 ..... N80-33027 #
INPE-1809-RPE/1977 ..... N80-33058 #
INPE-1811-RPE/179 ..... N80-33051 #
INPE-1813-RPE/181 ..... N80-33255 #
INPE-1821-RPE/187 ..... N80-32340 #
INPE-1824-RPE/190 ..... N80-33170 #
INPE-1826-RPE/192 ..... N80-33331 #
INPE-1827-RPE/193 ..... N80-32813 #
INPE-1835-RPE/197 ..... N80-33025 #
INPE-1842-RPE/202 ..... N80-33330 #
INPE-1844-RPE/204 ..... N80-33026 #
INPE-1845-NTE/162 ..... N80-32419 #
INPE-1849-RPE/206 ..... N80-32834 #
INPE-1862-RPE/212 ..... N80-33254 #
INPE-1863-RPE/213 ..... N80-33322 #

IR-1 ..... N80-32740 #
IR-1 ..... N80-33272 #
IR-6 ..... N80-32602 #

IRT-8162-006 ..... N80-33266 #

IS-M-274 ..... N80-33274 #
IS-M-280 ..... N80-32679 #

ISAS-579-VOL-45-NO-4 ..... N80-32442* #
ISAS-580-VOL-45-NO-5 ..... N80-33251 #
ISAS-581-VOL-45-NO-6 ..... N80-32331 #

ISRO-SAC-TR-09-78 ..... N80-32611 #

ISRO-SN-08-79 ..... N80-33048* #

ISSN-0110-1692 ..... N80-32571 #
ISSN-0372-1418 ..... N80-32331 #
ISSN-0372-1418 ..... N80-33251 #

ITPR-4 ..... N80-33088 #

ITR-1 ..... N80-33123* #

JHRP-79-16 ..... N80-32602 #

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PB80-190515 ..... N80-32479 #
PB80-190655 ..... N80-33018 #
PB80-190762 ..... N80-33303 #
PB80-190796 ..... N80-32965 #
PB80-190804 ..... N80-33020 #
PB80-190846 ..... N80-33307 #
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PB80-191034 ..... N80-32737 #
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PB80-191109 ..... N80-33004 #
PB80-191133 ..... N80-32481 #
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PB80-192453 ..... N80-32964 #
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PB80-192685 ..... N80-32735 #
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PB80-193071 ..... N80-33006 #
PB80-193147 ..... N80-33007 #
PB80-193378 ..... N80-33480 #
PB80-193535 ..... N80-32842 #
PB80-193634 ..... N80-32601 #
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PB80-195076 ..... N80-32532 #
PB80-195175 ..... N80-32706 #
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PB80-199078 ..... N80-32409 #
PB80-204258 ..... N80-32847 #
PB80-216690 ..... N80-32482 #
PB80-810807 ..... N80-32578* #
PB80-811912 ..... N80-32513 #
PB80-812324 ..... N80-32965* #
PB80-812332 ..... N80-33021 #
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PB80-812365 ..... N80-32579 #
PB80-812399 ..... N80-32967 #
PB80-812407 ..... N80-32968 #
PB80-812431 ..... N80-32580 #
PB80-812449 ..... N80-32581 #
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PB80-812530 ..... N80-32707 #
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PNL-3000-4 ..... N80-33200 #
PNL-3138 ..... N80-33072 #
PNL-3211 ..... N80-33073 #
PNL-3294 ..... N80-32873 #
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POLY-MRI-1404-80 ..... N80-32672 #

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PR-2 ..... N80-32823* #
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PRRL-79-CR-47 ..... N80-32921 #

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QPR-1 ..... N80-32878 #
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QPR-2 ..... N80-32875 #
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QPR-3 ..... N80-32915 #
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QPR-4 ..... N80-33224 #

QR-1 ..... N80-32723 #
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QTPR-1 ..... N80-32884 #
QTPR-1 ..... N80-32924 #
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QTSR-7 ..... N80-32978 #

R-873 ..... N80-33180 #

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RADC-TR-79-336 N80-32516 #
RADC-TR-80-9 N80-32519 #
RADC-TR-80-11 N80-32526 #
RADC-TR-80-42 N80-33110 #
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RADC-TR-80-66 N80-33106 #
RADC-TR-80-75 N80-32523 #
RADC-TR-80-108 N80-33258 #
RADC-TR-80-120 N80-32704 #
RADC-TR-80-139 N80-32686 #
RADC-TR-80-151 N80-32622 #
RADC-TR-80-158 N80-33294 #
RADC-TR-80-174 N80-32659 #
RADC-TR-80-179 N80-33109 #
RADC-TR-80-182 N80-32743 #

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RAND/P-6440 N80-33293 #
RAND/P-6479 N80-33326* #
RAND/P-6491 N80-33292 #
RAND/P-6492 N80-33291 #

RAND/R-2540-NSF N80-33120 #

RASA/SRL-14-79-05 N80-32398 #

REPT-2-15/DF1 N80-32820* #
REPT-2-800-03-379-51 N80-32483 #
REPT-02-4891-VOL-1 N80-32407 #
REPT-79-FM-10-REV-2 N80-32363* #
REPT-80-FM-43 N80-32364* #
REPT-80-2 N80-32693 #
REPT-80-10 N80-32781 #
REPT-80-036 N80-32641 #
REPT-80TR83 N80-32718* #
REPT-505-36-24 N80-32329* #
REPT-1987 N80-32545 #
REPT-3858-10 N80-33011 #
REPT-7273 N80-33054* #
REPT-814524-13-T N80-33102* #

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RLO-1388/444 N80-33193 #

RLO/2439-79/3 N80-32951 #

RPI-TR-MP-73 N80-32652* #

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RRC-80-R-679 N80-32999 #

R77-15 N80-32992 #
R80-1 N80-32328* #
R80-1 N80-32437 #
R80-912545-49 N80-32440* #
R80-914212-22 N80-32439* #
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SAN-0419-1 N80-32692 #
SAN-1295-T2 N80-32933 #

SAND-79-1401 N80-32648 #
SAND-79-1405C N80-32528 #
SAND-79-1483 N80-33290 #
SAND-79-1557 N80-32847 #
SAND-79-1674 N80-32786 #
SAND-79-1991C N80-32792 #
SAND-79-2006C N80-32894 #
SAND-79-2126 N80-32793 #
SAND-79-2134C N80-32895 #
SAND-79-2214 N80-32698 #
SAND-79-2270C N80-32938 #
SAND-79-7008 N80-32890 #
SAND-79-7018/2-VOL-2 N80-32870 #
SAND-79-7018/3 N80-32891 #
SAND-79-7097 N80-32896 #
SAND-79-7099 N80-32962 #
SAND-79-7109 N80-32977 #
SAND-79-8196 N80-32969 #
SAND-80-0123 N80-32560 #
SAND-80-0342 N80-32982 #
SAND-80-0486C N80-33194 #
SAND-80-0491C N80-32884 #
SAND-80-0539/1 N80-33298 #
SAND-80-0539/2 N80-33297 #
SAND-80-0587C N80-32935 #
SAND-80-0639C N80-32485 #
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SAND-80-0749C N80-32937 #
SAND-80-0865-REV N80-32987 #
SAND-80-1045C N80-32953 #
SAND-80-1155 N80-32872 #
SAND-80-1290C N80-33220 #
SAND-80-1301C N80-32795 #
SAND-80-1370C N80-32466 #
SAND-80-1589C N80-32936 #
SAND-80-7011 N80-32885 #
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SAND-80-7023 N80-32790 #
SAND-80-8212 N80-32501 #
SAND-80-8616 N80-32477 #
SAND-80-8707 N80-33275 #

SAPR-1 N80-32509 #
SAPR-12 N80-32826* #

SASR-1 N80-32807* #

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SC5172.10TR N80-32383 #

SD-TR-79-10 N80-32709 #

SDC-5540 N80-32897 #

SDSU-RSI-80-07 N80-32906* #

SEL-140 N80-33102* #

SER-510011-VOL-1 N80-32386 #
SER-510011-VOL-2 N80-32387 #
SER-510016 N80-32374 #
SER-510029 N80-32324 #

SERI-8119-3/2 N80-33276 #

SERI/PR-82741-1 N80-32924 #

SERI/TP-351-540 N80-32946 #
SERI/TP-351-545 N80-32888 #
SERI/TP-621-659 N80-32561 #
SERI/TP-631-567 N80-32955 #
SERI/TP-632-584 N80-32911 #
SERI/TP-721-574 N80-32948 #
SERI/TP-721-610 N80-32949 #
SERI/TP-731-626 N80-32863 #
SERI/TP-732-600 N80-32956 #
SERI/TP-733-617 N80-32947 #

SERI/TR-352-504 N80-32959 #
SERI/TR-98298-1 N80-32462 #

SGD-427-PT-1 N80-33329 #

SIT-DL-80-9-2124 N80-32343 #

SLAC-PUB-2490 N80-33201 #
SLAC-PUB-2524 N80-33200 #

SLSDC-291C-3 N80-32841 #

SOLAR/0010-80/05 N80-32966 #

SORI-EAS-80-065-REV-2 N80-33019 #
SORI-EAS-80-332 N80-33011 #

SP-212-1055 N80-32408 #

SQUID-PU-R2-80 N80-32401 #

SR-89-00434 N80-32818* #

SR-EO-00459 N80-32809* #

SR-PO-00474 N80-32808* #

SR-2 N80-33023 #
SR-4 N80-33041* #
SR-724-15-80 N80-32657 #

SRI-3777-1 N80-33019 #
SRI-6780 N80-33005 #
SR80-R-4392-43 N80-32495 #
SR80-R-4511-37 N80-32385 #

SSD-79-0010-3 N80-32860* #
SSD-79-0010-5 N80-32861* #
SSD-79-0010-6 N80-32859* #

SSL-SER-20-ISSUE-44 N80-32818* #
SSL-SER-21-ISSUE-5 N80-32815* #
SSL-SER-21-ISSUE-14 N80-32817* #

SU-DSE-4042-T10 N80-32876 #
SU-DSE-4042-T12 N80-32875 #

SU-GL-3149 N80-32589 #

SU-JIAA-TR-11 N80-33177* #

SU-TR-36 N80-33132 #
SU-TR-281 N80-33124 #

SWRI-02-4288 N80-32783 #
SWRI-11-5402 N80-33012 #
SWRI-14-5277 N80-33088 #

TAE-362 N80-32380 #
TAE-370 N80-32750 #
TAE-377 N80-32749 #
TAE-388 N80-32686 #
TAE-393 N80-32687 #

TAMU-REF-80-7-T N80-33077 #

TEB-80-13 N80-33018 #

TEES-3275-80-2 N80-32780 #

TN-1980-9 N80-32643 #

TPR-1 N80-32931 #

TPS-78-826 N80-32987 #

TPT-MA-02-3 N80-32417* #

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TR-2 N80-32526 #
TR-2 N80-33163 #
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TR-39 N80-32784 #
TR-53 N80-33158 #
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TR-68 N80-33125 #
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TR-80-05-01 N80-33168 #
TR-80-36 N80-33155 #
TR-80-41 N80-33131 #
TR-80-091 N80-33222 #
TR-137 N80-33152 #
TR-153-SER-2 N80-33160 #
TR-154-SER-2 N80-33161 #
TR-195A N80-33108 #
TR-282 N80-33150 #
TR-0080(5940-02)-3 N80-32709 #
TR-6419-01 N80-32777* #
TR-7822-VOL-4 N80-32358 #
TR-7901 N80-33143 #
TR-7905 N80-33130 #

TRW-32584-6015-RU-00 N80-33106 #
TRW-34129-6001-UT-00 N80-32686* #

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TSC-FAA-79-24 ..... N80-32371 #
TSC-FAA-80-6 ..... N80-32325 #

TSC-USCG-80-2 ..... N80-32369 #

TSD-2 ..... N80-32388 #

UCID-18710 ..... N80-33204 #

UCRL-TRANS-11554 ..... N80-32468 #
UCRL-TRANS-11580 ..... N80-33240 #

UCRL-15164 ..... N80-32908 #
UCRL-15171 ..... N80-32903 #
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UCRL-52000-80-6 ..... N80-32909 #
UCRL-52852 ..... N80-33114 #
UCRL-52914 ..... N80-32799 #
UCRL-52933 ..... N80-32907 #
UCRL-52942 ..... N80-32566 #
UCRL-83505 ..... N80-33244 #
UCRL-83515 ..... N80-33241 #
UCRL-83517 ..... N80-33236 #
UCRL-83518 ..... N80-33235 #
UCRL-83518-REV-1 ..... N80-33250 #
UCRL-83519-REV-1 ..... N80-33234 #
UCRL-83532 ..... N80-32505 #
UCRL-83562 ..... N80-33238 #
UCRL-83649 ..... N80-32714 #
UCRL-83653 ..... N80-32797 #
UCRL-83696 ..... N80-33208 #
UCRL-83808 ..... N80-32464 #
UCRL-83824 ..... N80-32940 #
UCRL-83829 ..... N80-33119 #
UCRL-83981 ..... N80-33245 #
UCRL-84018 ..... N80-33237 #
UCRL-84040 ..... N80-32882 #
UCRL-84046 ..... N80-32746 #
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UCRL-84109 ..... N80-33219 #
UCRL-84116 ..... N80-32649 #
UCRL-84303 ..... N80-32529 #
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UCRL-84369 ..... N80-33202 #
UCRL-84411 ..... N80-32926 #
UCRL-84443 ..... N80-32941 #
UCRL-84503 ..... N80-33074 #
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UILU-ENG-80-1702 ..... N80-33145 #
UILU-ENG-80-1712 ..... N80-33139 #
UILU-ENG-80-2205 ..... N80-33180 #
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UIUCDCS-R-80-1021 ..... N80-33139 #

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UIUCDS-R-80-1002 ..... N80-33145 #

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US-PATENT-APPL-SN-009886 ..... N80-32583*
US-PATENT-APPL-SN-023436 ..... N80-32392*
US-PATENT-APPL-SN-025163 ..... N80-33210*
US-PATENT-APPL-SN-051270 ..... N80-32604*
US-PATENT-APPL-SN-165910 ..... N80-32607* #
US-PATENT-APPL-SN-168995 ..... N80-32651* #
US-PATENT-APPL-SN-171933 ..... N80-32585* #
US-PATENT-APPL-SN-175453 ..... N80-33312* #
US-PATENT-APPL-SN-185865 ..... N80-33081* #
US-PATENT-APPL-SN-185867 ..... N80-32650* #
US-PATENT-APPL-SN-185869 ..... N80-32393* #
US-PATENT-APPL-SN-332123 ..... N80-32514*
US-PATENT-APPL-SN-374810 ..... N80-32514*
US-PATENT-APPL-SN-761252 ..... N80-32515*
US-PATENT-APPL-SN-803622 ..... N80-32484*
US-PATENT-APPL-SN-830846 ..... N80-32584*
US-PATENT-APPL-SN-918534 ..... N80-32650*
US-PATENT-APPL-SN-931217 ..... N80-32716*
US-PATENT-APPL-SN-933186 ..... N80-32515*
US-PATENT-APPL-SN-938293 ..... N80-32605*
US-PATENT-APPL-SN-936581 ..... N80-32359*

US-PATENT-APPL-SN-943086 ..... N80-32717*
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US-PATENT-CLASS-74-425 ..... N80-32716*
US-PATENT-CLASS-74-661 ..... N80-32716*
US-PATENT-CLASS-74-665C N80-32716*
US-PATENT-CLASS-75-124 ..... N80-32484*
US-PATENT-CLASS-156-272 ..... N80-32516*
US-PATENT-CLASS-156-292 ..... N80-32516*
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US-PATENT-CLASS-198-847 ..... N80-32717*
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US-PATENT-CLASS-236-44C N80-32583*
US-PATENT-CLASS-236-49 ..... N80-32583*
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US-PATENT-CLASS-239-265.33 ..... N80-32392*
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US-PATENT-CLASS-343-112R N80-32359*
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US-PATENT-CLASS-343-830 ..... N80-32604*
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US-PATENT-4,210,278 ..... N80-32583*
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US-PATENT-4,215,273 ..... N80-33210*
US-PATENT-4,215,327 ..... N80-32605*
US-PATENT-4,215,345 ..... N80-32359*
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US-PATENT-4,218,633 ..... N80-33186*
US-PATENT-4,218,650 ..... N80-32650*
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USAAVRADCOM-TR-80-D-16 ..... N80-32324 #
USAAVRADCOM-TR-80-F-14 ..... N80-32591 #
USAAVRADCOM-TR-80-F12 ..... N80-32495 #

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USAFETAC/DS-80/063 ..... N80-33062 #
USAFETAC/DS-80/064 ..... N80-33061 #
USAFETAC/DS-80/065 ..... N80-33063 #
USAFETAC/DS-80/066 ..... N80-33059 #

USARTL-TR-79-18 ..... N80-32374 #
USARTL-TR-79-27-B-VOL-2 ..... N80-32387 #
USARTL-TR-79-27A-VOL-1 ..... N80-32386 #
USARTL-TR-79-72D ..... N80-32358 #

USCG-D-09-80 ..... N80-32369 #
USCG-D-42-80 ..... N80-32971 #

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UTEC-CS-80-004 ..... N80-33178 #

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WSRL-0141-TR ..... N80-32832 #
WSRL-0148-TR ..... N80-32344 #

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